

Army
U.S. Surgeon General's Office
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A HISTORY OF PREVENTIVE MEDICINE
IN THE UNITED STATES ARMY FORCES
OF THE INDIA - BURMA THEATER

1942 TO 1945

by

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HISTORY OF PREVENTIVE MEDICINE

USAF - IBT

PARTS I & II

PART I - ADMINISTRATION AND ORGANIZATION

I: ADMINISTRATION AND ORGANIZATION

1. Development of Theater-Wide Preventive Medicine Service

To understand the slow, uneven growth of a unified and balanced preventive medicine program in the Asiatic Theater* one must first consider the growth of the Theater Medical Department organization. This is difficult unless one examines the tangled chains of command and administration which characterized the military organization in China, Burma, and India.

At the inception of the Theater, February-March 1942, four major commands were organized in the Theater: the "Theater" organization, with Theater headquarters and staff and a certain number of troops directly under the command of the Commanding General, CBI; the Services of Supply, also with commander, staff, and troops; the Air Forces, again, with separate command, staff, and troops which initially included the 10th Air Force plus certain general AAF troops; and finally, the Air Transport Command, which was directly under the control of the ATC commander in Washington, D. C. Approximately two-thirds of Theater Strength was included in AAF and SOS, with AAF somewhat superior in numbers.

Services of Supply and AAF were, of course, under the command of the Theater Commander. The two subordinate commands exercised their authority by delegation rather than by prerogative. In practice, however, they were virtually independent, except for adjusting their efforts to blend into the overall "big picture" outlined by Theater headquarters. The physical characteristic of the Theater made almost inevitable the crystallization of operations and responsibilities into nearly separate, though interacting, organizational entities. At the outset, Theater Headquarters was in Chungking, China, while Services of Supply and Air Force Headquarters were in New Delhi, India. More than the gap of many hundreds of miles and a barrier of storm-swept mountains separated the two echelons. In Chungking, all activities had to be coordinated with the Chinese officials; in New Delhi, all activities had to be worked out with British and Indian governments. Primary attention

* China-Burma-India Theater, 4 March 1942 to 24 October 1944; China Theater and India-Burma Theater, 25 October 1944 to present.

in Chungking was focused on the development of effective Chinese combat troops; attention in India was fixed upon the utilization and administration of American service troops and Air Forces combat and ground units.

The link between the two centers of activities was the Rear Echelon of Theater Headquarters, established in New Delhi. For the Medical Department, this meant that a Forward Echelon Medical Section of Theater Headquarters was located in Chungking; a Rear Echelon Medical Section of Theater Headquarters was in New Delhi. In addition, an SOS Medical Section was established in New Delhi, 8 June 1942, (having been moved from Karachi, which became the location of Headquarters, Base Section No. 1, SOS); and, finally, an Air Force Headquarters with Medical Section was located in New Delhi, and, later, in Calcutta. Close liaison between the various Medical Sections was difficult to carry out because of distances between Forward and Rear Echelon Headquarters, and because personnel was never sufficient to permit the assignment of liaison officers who would establish the necessary personnel connections between the various offices. While contact between SOS and Rear Echelon was easily possible, SOS frequently failed to accomplish its major purposes; communication was relatively poor between Rear Echelon and Forward Echelon which made the decisions on all major problems presented by SOS.¹

Within this diffuse pattern, a preventive medicine program had to be established. While all senior medical officers - Theater, SOS and AAF Surgeons - were acutely aware of the importance of preventive medicine in this tropical theater and discussed the problem jointly in their first weekly conference in the summer of 1942,² it is difficult, at a later date, to trace the outlines of a unified Theater program of preventive medicine, if one was developed in the early months of the Theater.

In view of events, it seems apparent that the plan of organization made the commander of each base, intermediate and advance section responsible for preventive medical activities, including sanitation and local malaria control, within his own area and among his own troops.³ Thus, Theater Headquarters would be responsible for Chinese and for such American troops as were part of the Theater command. However, at this point, Services of Supply was called in to assume responsibility for the sanitation and hospitalization at the Ramgarh Training Center, which was the principal concentration of Chinese troops in India prior to the deployment of Chinese for combat out of Ledo, Assam, into Burma.⁴ Services of Supply, with most of the troops of the Theater, was committed to military activities in almost every zone of India, and thus was

responsible for the prevention of communicable diseases at areas scattered over a sub-continent, and, as the China sector developed, between points separated by a good third of the globe. Air Force problems were similarly characterized by the dispersal of their troop locations. Presumably, each Surgeon would develop a staff capable of accounting for preventive medical activities under his jurisdiction, while the Theater Surgeon would exercise final supervision through a Medical Inspector and, when it was necessary to coordinate the activities of all commands, through appropriate Theater-wide directives.

As time went on, the practical difficulties of such a plan became apparent. Among such flaws, the problem of obtaining sufficient administrative personnel was most acute. Theoretically virtually complete and balanced preventive medicine sections should have been assigned to each Surgeon. Actually, there was neither sufficient personnel available, nor an adequate personnel allotment for the Surgeons' Staffs to provide such a well-developed system. As a consequence, the growth of the preventive medicine organization as a whole was uneven and specialists were scattered among the several Medical Sections. No surgeon had a complete preventive medicine group, but each had some of the members; pooling of the specialists available was not carried out until August 1944.⁵ While reading the description of the growth of the preventive medicine organization, it is advisable to recall, also, that due to the same shortage of personnel, every medical officer in a responsible position usually doubled or tripled his assignments in order to cover the gaps in the organization; if minor phases of one assignment were neglected, it was usually because the medical officer was also concerned with major aspects of another assignment. In many respects and for many months, the senior Surgeons of Theater, SOS and AAF resembled their junior counterparts, battalion surgeons, in being personally responsible for all aspects of medical service, from the supervision of sanitation to the preparation of medical plans for campaigns to be fought months - even years, perhaps - in the future.

Upon reaching Lashio, Burma, on 19 March 1942, the Theater Surgeon, Colonel Robert P. Williams, M. C., was plunged into the catastrophic events leading to the defeat of the Allied forces and the retreat from Burma. Almost before he was fully familiar with the military and medical situation, however, he was informed by British authorities that cholera and smallpox were appearing in epidemic degree among the civilian refugees who had been driven northward toward Mandalay after the fall of Rangoon. The day after the Surgeon reported to American Army Forces Headquarters at Maymyo, he made a trip to Mandalay and brought back cholera, smallpox, and

plague vaccines. His first medical plan directed that an inspection be made of all Chinese troops coming into the area to determine whether or not they had been immunized, and that troops not yet protected immediately be given their "shots". Thus, it may be said that the preventive medicine program carried out by American forces in Asia commenced with what proved to be a very successful element in the scheme, immunization.⁶

Two weeks later, the Surgeon, Services of Supply, Colonel John M. Tamraz, M.C., also became engaged in preventive medicine activities almost as soon as he reached the Theater. Lacking a staff of any sort, he spent a portion of his fifth day on duty as Surgeon inspecting hospital buildings being constructed at North Malir Cantonment. There he was introduced, much to his astonishment, to the British scheme for waste disposal, politely referred to as the "sweeper system". Water and plumbing were considered to be commodities too rare to be diverted to the disposal of excrement, even in troop areas, and the engineers objected to the use of septic tanks or deep pits on the grounds that the soil would be contaminated. Hence, relatively modern buildings - concrete structure, electric lights, fans, running water - were equipped with pail latrines and a bucket brigade of coolies. An immediate (and ultimately successful) protest to this arrangement was the result of the Surgeon's inspection, and, in effect, the preventive medicine service of the Theater launched its first **attack** on what was to be, in the end, one of its most acute problems, the control of filth-bred disease.

A week later, the Surgeon devoted his day to the problem of venereal disease control, attempting to obtain a suitable building for the establishment of a prophylactic station in the city of Karachi. On the following day, he turned his attention to general sanitation making an inspection of the troop area at the airbase of Karachi, paying particular attention to efforts made toward proper waste disposal, mess sanitation, and malaria control. And, on the next day, the Surgeon considered still another aspect of preventive medicine, the protection of troops through immunization. Conferring with British medical officers in the area, he was informed of the British practice in regard to immunization of troops against cholera (vaccination after the appearance of an epidemic, rather than before), and, thus reminded of the immunization program, investigated the status of American troops in the area in regard to immunization.⁷

At this point, the Surgeon's organization for preventive medicine was suddenly enlarged many times with the attachment of 15 members of the United States Public Health Service to the Services of Supply. This group had been sent to China and Burma in 1941 to provide medical cover for the construction of the Yunnan-Burma Railroad. (See Section 3, "Activities of the United States Public Health Service Group (1941 to 1943)" below). It included several executive and administrative officers, who were also qualified in medical specialties, sanitary engineers, entomologists, epidemiologists, and malaria control experts. The Senior Surgeon of this group had been contacted during the first Burma Campaign, and the Theater Surgeon had heartily endorsed the recommendation that the group be attached to the American Military Mission to China, and, subsequently, to the American forces in the Asiatic Theater. The transfer was accomplished in April and the group was turned over to the Services of Supply for duty.⁸ The Senior Surgeon, Lieutenant Colonel Victor H. Haas, was retained in the office of the SOS Surgeon, after he had made some initial field surveys of areas to be occupied by American troops, and in fact, if not in title, became the chief of preventive medicine in the Theater, as well as the Services of Supply. His staff, which was placed entirely in the field, included his group of Public Health Service officers.

With the addition of this group of specially trained officers to the Theater medical organization, activities proceeded upon two related but somewhat distinct lines. As new sites were selected for troop areas - Agra, Allahabad, New Delhi, Karachi, Calcutta, Gaya, Chabua, Dinjan, Ramgarh, Ledo, and Kunming - one or more officers were assigned to the advance party to make a preliminary survey of the area, and, as troops began to move in, to supervise the installation of sanitary facilities, assist local surgeons, advise commanding officers of their responsibilities for developing and enforcing various sanitary disciplines, and inform the Surgeon, SOS of the status of preventive activities in the field. They were also made the agents through whom information in regard to medical and sanitary supplies was passed to local commanders and their surgeons, and they were instructed to impress upon those who were responsible for planning and action the need for foresight and preparation in regard to protecting the health of the command. Frequent reports from them to their Chief in the SOS Surgeon's office permitted him, in turn to advise the Surgeon on the status of sanitation and prevention in the field so that he could consolidate information on conditions in the Theater, develop plans, and urge necessary action upon the SOS commander.

The second phase of action carried out by this organization was in regard to malaria control. Problems of general sanitation could be dealt with on the basis of limited areas and separate local commands in accordance with conventional methods of procedure outlined by Army Regulations. The problem of malaria control, however, did not lend itself to a scheme of individual, local responsibility. In the first place, malaria was a new problem to many medical officers, most commanders, and all troops; they needed expert guidance. Troops as well as commanders had little faith in measures against an insect which seemed ubiquitous, especially when the success of such measures seemed to depend upon a good deal of inconvenience, diversion of personnel, and discomfort. In the second place, environmental control had to be carried out on a broad inter-command scale if it was to be successful; effort had to be pooled, and administration needed to be flexible and independent enough to establish priorities for operations and equipment without regard to the particularities of local organization. And, in the third place, certain phases of the activities had to be carried out by specialists with special supplies and equipment; both necessities were scarce in the Theater and could not be used efficiently without the development of a unified plan.

The U.S. Public Health Service officers attached to the various installations in the Theater were thus engaged in the development of a general program to cope with the malaria problem, as well as acting as assistants and advisors for specific programs of sanitation in individual troop areas. Their action could be taken only in part by including recommendations on malaria control with advice on general sanitation which were presented to local commanders, whether they were in S.O.S., A.A.F., or Theater. Theoretically they were the agents of a larger organization for anti-malarial activities, but they were more or less directly responsible for the program in the areas to which they were assigned, although their role was merely advisory.

In certain respects, this organization was an excellent practical measure but a bad precedent. It placed specialists in the field where less qualified personnel would have been unsuccessful in dealing with the unfamiliar problem of malaria control. It provided the surgeon ultimately responsible for the majority of preventive medical activities - the S.O.S. Surgeon - with field representatives who were directly under his supervision, so that the allocation and distribution of supplies, the establishment of anti-malarial practices and policies, and the coordination of the preventive medicine program could be controlled.⁹

The first disadvantage, which did not appear until some time later, was that malaria control, in the minds of troops and their commanders, was put into an unusual category. Instead of joining venereal disease control as one of many command responsibilities, it dropped into the category of hospitalization, which was a Medical Department responsibility. When the U.S.P.H.S. officers had been attached to S.O.S., their advisory status was specified. However, no one as acutely aware of the dangers inherent in the lack of anti-malarial measures could stand by idly if local commanders proved to be reluctant to take necessary control measures, or exhibited lack of knowledge on the subject.¹⁶ By the time the U.S.P.H.S. officers reached the field, the malaria season had already begun so that no time was lost in starting control measures. In the absence of Theater directives, they outlined S.O.P.'s to be established wherever they were assigned; in the absence of trained personnel, they persuaded commanding officers to detail small squads who would carry out environmental control measures under their supervision. The system unquestionably worked, and without the ready initiative of the U.S.P.H.S. officers, as well as their technical knowledge, the early American forces might have fared badly. A precedent was established, however, which later became troublesome.

A second disadvantage which appeared later was that the preventive medicine program actually being developed in the field appeared to be entirely an S.O.S. operation. Yet, at the same time, it was not intended that the commanders of major commands in the Theater should relinquish their sanitary responsibilities even though only S.O.S. had the personnel and supplies available to exercise those responsibilities. The difficulty lay in the fact that the program had not been outlined fully at the outset, specifying areas of control and responsibility. Thus, the Theater Surgeon himself placed a requisition for spraying equipment, since on his way to Burma, he had learned that the All-India Institute of Hygiene and Public Health was able to produce a limited number of the sprayers. He also directed the distribution of the equipment.¹¹ However, other sanitary supplies were handled by S.O.S., with the Surgeon and his assistant taking the initiative in tracing down delayed shipments, uncovering local sources of insecticides, and arranging for distribution to field units.¹² Although the S.O.S. Surgeon noted at an early date the danger lurking in the absence of a unified sanitary program, and recommended the publication of a Theater directive on malaria control (the principal problem being considered),¹³ the memorandum which was issued by Theater to S.O.S., A.A.F., and certain special commands, was informative only, and did not touch upon the problem of controlling and unifying the preventive medicine program along clearcut lines of responsibility.¹⁴

In 1942 operations were on too limited a scale for the lack of overall organization to be a serious handicap. However, it later appeared that it was not intended that S.O.S. should, in fact, be delegated the responsibilities for malaria control as it had been delegated hospitalization on a Theater-wide basis, but that, instead, each separate command was still responsible for this as well as other preventive medicine activities, with the Theater Surgeon maintaining ultimate control. Presumably, with this arrangement in mind, it would have been more proper to have retained the U.S.P.H.S. group directly under Theater control, with its Chief acting on behalf of the Theater rather than the S.O.S. Surgeon. However, this scheme would have been less natural than the one adopted: the Theater Surgeon was devoting all his attention to the medical rehabilitation and technical training of Chinese forces coming into India after their retreat from Burma; his office was with Forward Echelon in Chungking, although he spent a large proportion of his time in the field. On the other hand, the primary need for malaria control and general sanitation was in the base areas of India, within S.O.S. jurisdiction, and the S.O.S. Surgeon's medical section was well established in the heart of the S.O.S. area. Hence, the placement of the balance of preventive medicine personnel with S.O.S. was practical and logical. Here again, however, a precedent was set, which, when changed early in 1943, evoked surprise and some confusion.

Although malaria control continued to occupy the primary attention of all personnel engaged in preventive medicine activities, action on other phases of the program was undertaken in the late summer and autumn months of 1942. Inspections by the Theater and S.O.S. Surgeons of troop areas were made periodically to determine the quality of general sanitary measures against filth and water-borne diseases.¹⁵ Venereal disease control was considered in the light of a rising problem at the port of Karachi and in New Delhi.¹⁶ Nutritional problems of American and Chinese troops became the fulltime concern of the newest addition to the prevention medicine group, a Sanitary Corps specialist in food and nutrition. This officer was assigned to the Surgeon's staff in July 1942, where he acted as the local inspector of food and of civilian restaurants in the New Delhi area. As soon as he had become familiar with his new assignment, he undertook series of inspections which covered all areas where American troops were concentrated.¹⁷

The position of Nutritionist was kept open on the staff of the Surgeon S.O.S. as long as the Theater existed. Other similar officers were furnished the Theater in 1943 and 1944 so that each principal area of the Theater (outlined by S.O.S. Section boundaries) was provided with a specialist on this important subject.

These officers made continuing studies of the troop ration, mess installations, and hospital diets, advising their Surgeons on the status of nutrition and making recommendations which could be presented to commanders or to Quartermaster officers who procured, stored, and issued rations. Their findings also were the basis for decisions relative to the issuance of multivitamin tablets to supplement the ration under certain conditions and in certain areas. Although the progress toward an improved troop ration was slow and sometimes discouraging, this element in the preventive medicine program was one of the best organized and controlled sections in operation. The nature of its mission enabled it to work almost entirely with one echelon, Service of Supply, which was charged with the supply of rations; hence, confusion over areas of responsibility did not arise, and there was little controversy between the Theater and S.O.S. medical sections as to which would exercise control and bear responsibility.¹⁸ (See also chapter on Nutrition below).

Before the end of 1942, another addition to the S.O.S. Surgeon's staff opened the way for greater efforts against venereal diseases when an officer was assigned and designated as Venereal Disease Control Officer.¹⁹ At almost the same time, an officer was sent to the Theater from the Office of The Surgeon General to make an inspection of venereal disease control. His survey showed that while commanders at all installations evidenced interest in improving anti-venereal measures, lack of equipment, training aids, recreational facilities, cooperation from civilian authorities, and co-ordination between line and medical officers had hindered the development of an effective program.²⁰ These problems became the charges of the new Venereal Disease Control officer, who, although he was on the S.O.S. staff, necessarily acted unofficially as the VD Control Officer for the entire Theater. This de facto status was recognized early in 1943 by the Theater Surgeon, who obtained the transfer of the VD Control Officer to his own staff in Rear Echelon headquarters,²¹ leaving a vacancy in the S.O.S. preventive medicine organization, but placing the single specialist engaged in this work at the highest possible staff level so that the results of his actions could be made effective in all major commands and troop areas.

The advantage of this utilization of the VD Control Officer, in the absence of sufficient personnel to place similar officers in all Surgeons' offices, was seen when it came to holding unit commanders personally responsible for high venereal disease rates in their own organizations. The VD Control Officer on the Theater Surgeon's staff was in a position to obtain and consolidate statistics from all commands in the Theater. These were analyzed and summaries presented to the Theater Surgeon, indicating the units with rates significantly above the Theater average, and,

also, units with low rates. Upon receipt of this information, the Theater Surgeon then prepared letters for the signature of the Commanding General of the Theater calling for increased efforts against venereal disease on the part of commanders whose units showed high incidence, and commending those whose units persistently showed good venereal control discipline.

Thus, the proper integration of line and staff was obtained at an early date on an administrative level which was high enough to cover all commands authoritatively. Had the VD Control Officer remained with S.O.S., his efforts could not have extended to Theater or Air Forces areas, which were not responsible to the Commanding General, S.O.S. It is probable that the authority to augment the staff of the Theater Surgeon was granted because conventional Army practices emphasized the relationship of command to the venereal disease control program, and command, in turn, was interested in obtaining the assistance of specialists because its responsibility to higher authorities was clearly defined. The allotment of specialists for other preventive activities was slower because the importance of sanitation had to be "sold" to a greater extent among troops used to living in a less hostile environment.²²

As the summer of 1942 drew to a close and the peak period for malaria passed, the thoughts of the S.O.S. Surgeon and his assistant from the P.H.S. turned toward the coming year. It was obvious that planning could hardly be started too soon, since the long sea routes to the Theater, already endangered by marauding Japanese submarines and the German Luftwaffe operating in the Mediterranean area, threatened the development of all future operations. Since the malaria control organization then in existence was a part of S.O.S., the S.O.S. Surgeon took the initiative in the planning program, amply furnished with forecasts and schedules by the P.H.S. personnel.²³ By the first of October, a list of supplies to be needed in 1943 was sent to the Chief of Staff, S.O.S., and tracer memoranda were sent out periodically. By December, the responsibility for planning was formally delegated to the S.O.S. Surgeon by the Theater Surgeon, and it was specifically stated at that time that the S.O.S. would be required to assume responsibility for malaria control operations in all troop areas. "Tactical units must be considered transients and malaria control work must be continuous."²⁴ This decision was repeated in response to an enquiry from the 10th Air Force, which, noting that malaria control needed a comprehensive, rather than a sectionalized form of organization, urged the formulation of an inclusive program at an early date. In reply, 10th Air Force was instructed that, as in the summer of 1942, S.O.S. would continue to be responsible for area malaria control activities, and that senior medical officers

attached to troop units should present their own local plans to the special malaria control officers assigned to the area. Supplies were to follow the same lines of authority as personnel, with S.O.S. being responsible for anti-malaria equipment for all commands.²⁵

During December, the opportunity was presented to strengthen the malaria control organization in the Theater by the acquisition of special malaria control units. These were the new units which had been tentatively set up by the Surgeon General as Theater-type organizations. They included a Theater Medical Inspector Special (Malariaiologist), assistants, and operating units consisting of both survey and control elements. The S.O.S. Surgeon proposed to obtain three control and three survey organizations from the United States, and recommended that Lt. Colonel Earle M. Rice, M.C., be designated to direct the entire program. This officer had been with the military observers group in the Theater and had already proved to be of great assistance to senior medical officers because of his knowledge of Indian health problems. The proposal was approved and the necessary requisition sent to the United States in mid-December.²⁶

The program was laid down in a directive embodying the plan of the S.O.S. Surgeon; the directive, however, was issued by Theater Headquarters in order to evoke compliance from all major commands, of which S.O.S. was but one of three. As outlined, unit commanders were responsible for enforcing individual protective measures and anti-malaria discipline. Commanders of S.O.S. base and advance sections were charged with environmental control and mosquito proofing of buildings. S.O.S. malaria control officers attached to the S.O.S. Section Headquarters were to advise, supervise, inspect, and report to higher headquarters on the development of the anti-malaria program. Finally, a malariologist on the staff of the S.O.S. Surgeon was to maintain overall supervision and advise surgeons of all commands (including Theater) as to the malaria situation. Unfortunately, Section malariologists, although representing the senior malariologist in the Theater, were to take direct action only in the case of S.O.S. units. To deal with A.A.F. or Theater organizations, they were expected to go through the malariologist on the S.O.S. Surgeon's staff who was granted the authority to deal directly with commands other than S.O.S.²⁷

Approval by the War Department of the requisition for the anti-malaria units and the assignment of Lt. Colonel Rice as Theater Malariologist took the program out of the planning stage in February 1943.²⁸ To the surprise of the S.O.S. Surgeon,²⁹ however, the Theater Malariologist and, later, his Assistant

Theater Medical Inspectors Special (Malariaologists) were placed on the staff of the Theater Surgeon. At the same time, the S.O.S. Surgeon lost the services of the U.S.P.H.S. officer who had supervised the 1942 anti-malaria and sanitary program when that officer was sent to Ledo to study the malaria and sanitary problem in the area which was to be the base for combat and road-building operations during the next three years; after completing his study, he remained in the area as the Surgeon for the S.O.S. Section (Base Section No. 3).

Thus by March, when the earliest phases of the 1943 malaria control program were to be commenced, there had been a shift in the Theater organization which removed S.O.S. from the controlling position. Obviously, as long as anti-malaria personnel was scarce, it was logical to place senior administrators in the senior headquarters, as was being done later in March with venereal disease control personnel. To conform to this change, incoming malaria control and malaria survey units, which began to arrive at the end of May, 1943, were considered to be "Theater" troops (i.e., under the direct control of Theater Headquarters).³⁰

However, as the new Theater Malariaologist pointed out, for the previous eleven months malaria control had been an S.O.S. function, carried out by the P.H.S. officers who were part of the S.O.S. organization. Hence he recommended that the responsibility for malaria control be delegated to S.O.S. as it had been in the past.³¹ Nevertheless, the next organizational outline established for malaria control, although it made almost no change in the previous scheme for malaria control activities, indicated that final supervision would rest with the Theater rather than an S.O.S. Malariaologist. S.O.S. Section commanders remained responsible for environmental anti-malaria activities, but they were required to use Theater malaria control troops, including the Assistant Theater Malariaologists, who were only attached to S.O.S. for administration and duty.³² This duality of organization was logical from the viewpoint of the Theater organization as a whole, since it placed final responsibility on the shoulders of the senior medical officer. But it was confusing to the personnel actually in the field inasmuch as those who were carrying out malaria control activities were not directly responsible to the commanders in the areas where they operated, nor could the same commanders deal with their operating personnel except through a separate and higher headquarters.

This objection was partially diminished in August, 1943, when a new directive³³ gave SOS Section commanders, to whom malaria control and survey personnel were attached, the authority to move personnel within their Sections without reference to higher authority, and authorized the Commanding General, SOS to move personnel from one SOS Section to another, providing he obtained the concurrence of the Theater Malariaiologist or his assistants.³⁴ This change did not do away with the double line of administration running from both Theater and SOS headquarters, with the cross-overs connecting the two to be found only in New Delhi or in areas where assistant Theater Malariaiologists were on hand to bridge the gap between supervisory and operating personnel. However, it did give local SOS commanders greater freedom to carry out their responsibility for environmental control without so much reference to higher headquarters. The double line was noticeable in the pipeline of anti-malaria supplies, which were procured and stored by SOS depots but were allocated and distributed under the supervision of the assistant Theater Malariaiologists. This control of supplies was exercised far more diligently by the Theater Malaria Control supervisors than was control over units. The units were presented with such immense areas over which to operate that as long as they stayed within their boundaries, they could scarcely ever be in zones where need for their services was not great. On the other hand, supplies were so scarce that very strict care had to be maintained to see that they were distributed to critical points at critical times. Priorities for areas were established by the Theater Malariaiologist and supplies allocated on the basis of a percentage schedule. General Depot No. 2 at Calcutta was designated as the Theater supply point for anti-malaria supplies and was instructed to issue its stocks only on requisitions approved by assistant Theater Malariaiologists of the areas from which the requisitions were sent.³⁵

When in July 1943, the War Department adjured all Theater Commanders to place particular emphasis upon the prevention of malaria,³⁶ the anti-malaria organization in existence was believed to be capable of dealing effectively with the problem. The control of anti-malaria supplies had been concentrated by withdrawing them from Quartermaster or Engineer control, where they normally would be stocked.³⁷ The allocation of personnel conformed both with past practices and to the need for placing control at the highest organizational level; thus, SOS was actually dealing with malaria control units but Theater was exercising the prerogative of the senior command.

The scheme, however, was not without its unwieldy characteristics. As the Assistant Theater Malariaiologist noted, the intervention of two command headquarters between supervisory and operational anti-malaria personnel sent all action a long way around before it reached completion; to give an order to a Malariaiologist in the field (attached to the staff of an SOS Section commander) the Theater Malariaiologist technically was required to recommend that the Theater Commander advise the SOS Commander to direct his SOS sub-section commander to give the necessary order to the Malariaiologist in the field. Except for the fact that matters were commonly handled much more informally, it was a confusing house that Jack had built.

With the thought of eliminating some of the disadvantageous aspects of dual command and administration, the Theater Malariaiologist developed the outlines for a "Malaria Control Regiment." Under command of the Theater Malariaiologist (or, vice versa, with the commander of the Regiment to be the senior malaria control authority in the Theater), the "Regiment" would be formed of a number of battalions, each commanded by the equivalent of the officer then designated as Assistant Theater Malariaiologist. The battalions would in turn, consist of malaria control and malaria survey companies. Under this system, the Regiment would be responsible for the entire anti-malaria program in the Theater. SOS would revert to its "normal" role of supply agency for anti-malaria items. This proposal was presented to the Theater Surgeon who, after some delay (being in the field), asked for further details. As an alternative to the formation of a Regiment with sufficient companies to meet the requirements of the Theater, the Malariaiologist proposed either enlargement of the T/O of existing malaria control units or the requisition of an additional number of units. The approval of an increase in malaria control units was obtained from War Department, and although interest in the malaria control regiment continued into 1944, the project was not carried out and more conventional forms of organization continued to be followed. Although the project may be only of academic interest at the present time, it represented the desire of malaria control personnel then charged with anti-malaria activities for increased control and more direct command channels in which operations were to be carried out.³⁹

While the malaria control organization for 1943 was evolving other developments in the preventive medicine sections of the Theater and the SOS Surgeon's offices occurred. By March 1943 the Theater Surgeon's preventive medicine staff consisted of the Theater Malariaiologist, and the SOS Surgeon's preventive medicine staff included the Nutritionist and the Venereal Disease Control Officer; most of the original group of U.S.P.H.S. officers

remained on duty in the field. Early in March a new officer was assigned to the S.O.S. Surgeon's staff, a Lt. Colonel, M.C., who was immediately designated as the Chief of Preventive Medicine, S.O.S., and S.O.S. Medical Inspector. This was the first occasion when an officer had been available and designated for either position, the Surgeon himself having previously taken the two assignments as part of his principal duties.

At the end of March, the S.O.S. Surgeon lost his Venereal Disease Control Officer to the Theater Surgeon's Rear Echelon staff, which thereby received its second member whose principal duty was disease prevention. In June, the Theater Surgeon's staff was further increased by the designation of four assistant theater malaricologists; these officers had come to the Theater with the anti-malaria units in the preceding months and although they were carried as part of the Surgeon's headquarters personnel, they actually were fully occupied in the field until the height of the malaria season, when one was recalled to the Rear Echelon office in New Delhi to handle administrative problems while the theater malaricologist was in the field. This assistant became acting theater malaricologist when the theater malaricologist (Lt. Colonel Earle W. Rice) was transferred to S.E.A.C. in November 1943.⁴¹

The new Preventive Medicine Chief's tour of duty in the S.O.S. Surgeon's office was brief. In June he was reassigned as commander of the 100th Station Hospital in New Delhi, leaving a vacancy in the S.O.S. Surgeon's office which was not subsequently filled. In August the same officer was assigned to the Theater Surgeon's staff where he was designated Theater Medical Inspector,⁴² and in addition, was directed to act as the Theater Surgeon's representative in Rear Echelon Headquarters. The effect of this change on the Theater preventive medicine organization was akin to that arising from the transfer of the Venereal Disease Control Officer from the S.O.S. to Theater Surgeon's staff--centralization in lieu of the formation of a series of complete preventive medicine staffs at each level of administration.

Unfortunately, the duties required of this officer as the Theater Surgeon's **representative** in Rear Echelon headquarters precluded his functioning as a Medical Inspector,⁴³ particularly in the absence of a well-organized group of field representatives who could carry out the actual inspection work. What was needed was not only a supervisor but an individual who was able to spend all of his time in the field, where much needed to be done to improve sanitation, water supply facilities, good mess sanitation, and the like.⁴⁴ The later assignment of another officer to be Medical

Inspector, while the first remained as the Theater Surgeon's deputy, did not remedy the situation because the second officer, while well qualified professionally, was unable to carry out strenuous and extended field trips over the vast expanse of territory encompassed in the boundaries of the C.B.I. Theater.

Thus, at the end of 1943, the two principal medical sections in the Theater contained the following preventive medicine organization:

The Theater Surgeon had a medical inspector, a venereal disease control officer, a matriologist, and three assistant matriologists. The assistant matriologists were in the field but the others spent most of their time at Rear Echelon in New Delhi.

The S.O.S. Surgeon was without any preventive medicine personnel except for the Nutritionist. Malaria control and survey units, although specifically designated as Theater troops, were attached to S.O.S. commands for administration and, in effect, operation. Control of anti-malaria supplies rested with Theater personnel, but was handled by S.O.S. medical supply officers.

There were obviously many gaps in the preventive medicine organization which had to be filled by the Theater or S.O.S. Surgeon personally. In many instances, reliance had to be placed on written directives to the field which were issued to cover various aspects of preventive medicine, but the effect of which could not be checked in detail owing to the lack of inspecting and supervisory personnel. Thus, directives were issued during 1943 on the sanitary preparation of foods; on precautions against rabies; on water sterilization and supply; on prevention of heat exhaustion; on the dangers of ice from unauthorized sources; on immunizations; on screening of buildings; and on sanitary measures to be taken during troop movements.⁴⁵ Checks on the efficacy of these directives could be made only hastily, in the course of tours of hospital installations by the S.O.S. or Theater Surgeon, or where senior medical personnel were in the field for various purposes. Surveys of the adequacy of venereal disease control measures were made continuously by the VD Control Officer, who noted disease rates from periodic statistical reports; reports from matriologists and anti-malaria units in the field similarly kept the Theater Matriologist informed of the conditions each month.

As 1943 drew to a close, plans were proposed for the enlargement of the Theater preventive medicine organization. The Theater population had risen rapidly in 1943 and was projected for 1944 up to as high as 228,000 American and Chinese troops, for

whom medical service was authorized. Except for the increase in the number of malaria control and survey units assigned to the Theater, however, no similar expansion had occurred in the sections responsible for supervision and control of preventive medicine activities. The mere addition of more medical personnel to the Theater strength did not go far to develop the preventive organization. The majority of medical personnel were in hospitals or similar medical units; medical officers attached to new troop units, while available to assist in the preventive program as part of their organization duties, were unfamiliar with tropical conditions and with the necessary measures for combatting the prevalent insanitary conditions which threatened the health of troops.

In the autumn, the Theater Surgeon drew up a plan for enlargement of the Theater Surgeon's staff, using the outline of T/O 200-1 (Army Headquarters) with additional personnel to handle preventive medicine and certain special administrative functions of his office, such as the consolidation of vital statistics. He hoped to set up a Rear Echelon Headquarters Medical Section under his Deputy which would include a Theater Medical Inspector, Theater Malariaologist, Theater Sanitary Officer, Theater Food and Nutrition Officer, an Epidemiologist, a Statistician, and a Theater Venereal Disease Control Officer. In Forward Echelon, (China) under his own guidance he hoped to have a streamlined replica of his Rear Echelon section to consist of an Assistant Medical Inspector, Assistant Malariaologist, Assistant Venereal Disease Control Officer, and an Assistant Theater Epidemiologist. With this organization, he would insure the complete coverage of preventive medicine activities both in India and Burma and in China (where somewhat different problems existed). The personnel in Rear Echelon would have major responsibility for planning and supervising the Theater preventive program, while those in forward Echelon would be charged with local planning and operations for the China sector and with liaison with Chinese medical authorities.⁴⁶

Unfortunately, so extensive a development of the preventive medicine organization was not made possible until August 1944; meanwhile, the staff in S.O.S. and Theater medical headquarters remained static. However, the organization of the malaria control program was again modified in an all out endeavor to curb the excessive incidence of the disease by better planning and by increasing the number of anti-malaria units. Advantage was taken of the Supreme Allied Commander's (S.E.A.C.) clear enunciation of the responsibilities of command for anti-malaria discipline.⁴⁷ By this time the entire theater was extremely malaria-conscious,⁴⁸ and in compliance with War Department directives, plans had been laid for

an extensive educational program among the troops.⁴⁹ Supplies were more abundant than they had been in the past, and there was hope that DDT would soon become available.

The desire to take full advantage of command authority in regard to malaria control (including use of suppressive atabrine therapy in combat commands) revived interest and concern over the malaria control organization. Command responsibility could generally be exercised in local situations only after proper advice had been received from qualified malaria control personnel. However, under the existing system, such personnel were but attached to their local A.A.F. or S.O.S. headquarters, and were assigned directly to Headquarters of the Theater. Thus, their reports were not sent through intermediate command channels since no such intermediate headquarters had authority over the malaria control activities carried out by anti-malaria units. Distribution of malaria reports through each unit headquarters concerned would have meant diffusion, delay, and duplication.⁵⁰

At this juncture, the matter was settled when instructions were issued by the Theater Commander to divorce the Theater Headquarters staff from all operations, leaving it free for planning and supervision. S.O.S. was to assume all operative functions which were not clearly proper to local unit commanders. To conform to this new plan, the malaria control organization of the Theater was turned over to S.O.S. entirely in April 1944, leaving only a Theater Malariaologist on the staff of the Theater Surgeon. Malaria control and survey units, as well as malarologists designated to assist Surgeons on the staffs of subordinate commanders, were assigned to S.O.S. The Theater Malariaologist was deprived of his authority to direct the activities of such units and was relegated to the position of a coordinator and advisor. The anti-malaria units were assigned to S.O.S. Section commanders, or to the commanders of tactical units such as the Northern Combat Area Command (none were assigned to A.A.F., although many actually carried out their work at A.A.F. or A.T.C. installations).⁵¹

According to the new directive, personal protective measures were to be enforced by command discipline, and were to be viewed by superior commanders as an index of the efficiency of any unit commander. Services of Supply was made responsible for the control of malaria and was ordered to direct its Base and Advance Section Commanders to take all necessary actions to meet their responsibility. Procurement and issue of anti-malaria supplies remained with S.O.S. Monthly reports by the malarologists

of each S.O.S. Section were to be sent to Theater Headquarters (Rear Echelon) rather than to S.O.S. headquarters, however; information copies only were to be directed to the Theater Malariaiologist and to S.O.S.

No one was satisfied with the new arrangement. The Air Forces protested that the new directive was contrary to established regulations in that it presumed to absolve unit and area commanders of their responsibility for the initiation and enforcement of malaria control measures. A practical disadvantage to the arrangement, as far as Air Force troops were concerned, was that, with malaria control enforcement areas outlined by the boundary lines of S.O.S. Sections, dispersed A.A.F. troops were likely to come under the jurisdiction of several different malaria control programs and agencies. The alternatives, for A.A.F. headquarters, were to abandon its responsibility for malaria control in A.A.F. troops to other commands--which was not authorized by War Department directives--or attempt to issue a single A.A.F. directive on malaria control which could be applicable wherever A.A.F. troops were serving.

With these objections, S.O.S. agreed. While such elements of malaria control as mosquito proofing of buildings, drainage, spraying of native habitations, and the activities of anti-malaria units might conceivably be delegated to S.O.S., it was not apparent how the A.A.F. could be relieved of, or S.O.S. assume the responsibility for malaria education, discipline, and enforcement of malaria control measures. It was also obvious that since maintenance of the environmental measures of malaria control was an integral part of unit malaria control discipline, particularly when local troops were engaged in carrying out barracks and company areas control measures, it was doubtful if even these activities could be entirely divorced from other command responsibilities.

The Theater Malariaiologist added his weight to the regrets that the new system was required in order to carry out the new "hands off" policy for operations which Theater Headquarters had adopted. The defects of the organization included the fact that the Theater Malariaiologist, responsible for coordination and advice, was too completely removed from operations to force the malaria control program to a high peak of effectiveness. Recommendations which had to be passed through several headquarters (at least three Theater, S.O.S., and S.O.S. Sections) before reaching their destination lost their punch and were delayed in their delivery. A second defect was the inability to formulate centralized or uniform policy. Each S.O.S. Section, exempt command (such as the American Delhi Military Area Command) and combat command needed its own

malaria control directive and carried out its planning and supervision with its own staff malariologist. Thus a single unit, such as a malaria control unit or an A.A.A. command, might easily operate under two directives, since the possibilities for spreading a small number of troops over a large area were almost unlimited in India.

The Theater Malariologist pointed out, however, that Section Commanders had issued directives which clearly indicated unit responsibilities and were modeled closely on previous Theater directives, so that policies were similar if not identical throughout the Theater. "Gentlemen's agreements"--unsatisfactory but necessary--had heretofore bridged any gaps in the organizational structure and could be expected to continue, with favorable results. Still he concluded, "Continuous conflict is anticipated as long as the present stand-off policy of non-intervention in operations assumed by the Theater Headquarters is in existence as far as malaria control is concerned. This will undoubtedly be most apparent in the enforcement of malaria discipline... The only solution that I can see is the resumption of responsibility for malaria control by the Theater Headquarters." With this analysis S.O.S. thoroughly agreed, particularly since it now was called upon to assume full responsibility for malaria control and its Surgeon's staff was without a Malariologist! The difficulties of S.O.S. were visible both in the combat and in the communications zones. In Burma, S.O.S. Base Section No.3 worked in conjunction with the Northern Combat Area Command, areas and units being contiguous and overlapping. Here, "gentlemen's agreements" were absolutely necessary on matters of supply, labor, and environmental sanitation if a continuous service was to be supplied. In the communications zone, A.A.F. and S.O.S. were coequals in the chain of command. Instructions or advice from S.O.S. on matters of malaria discipline or area control were bound to cause resentment even if the desired results were obtained. Similarly, in China, malaria control represented the only S.O.S. function in an otherwise All-A.A.F. area.⁵²

The solution to the problem was the consolidation of the staffs of the Theater and S.O.S. Surgeon. This merger occurred 22 August 1944.⁵³ The S.O.S. Surgeon was given the added position of Deputy Theater Surgeon so that the joint staff was unified administratively as well as practically. All operating personnel from the Theater Surgeon's office was transferred to the office of the Deputy Theater and S.O.S. Surgeon, the Theater Surgeon retaining only two administrative assistants. Besides consolidating personnel into one unified staff, the double allotment of personnel (one allotment from each headquarters) permitted an increase in the size of the staff.

A new Preventive Medicine Section was established in August 1944. At the outset it consisted of the Theater Medical Inspector, Theater Malariaologist, Theater Epidemiologist, Theater Venereal Disease Control Officer (all formerly with the Theater Surgeon) and a Theater Food and Nutrition Officer (formerly with the SOS Surgeon). A new Medical Inspector was appointed vice the former officer, who was rotated to the United States, and, in rapid succession, an epidemiologist and a sanitary engineer were added to the preventive medicine section in the autumn of 1944. Late in the year the position of Assistant Theater Medical Inspector was created and a new Chief of Preventive Medicine and Theater Medical Inspector appointed so that it would be possible for either the Chief or the Assistant to be in the field a good deal of the time instead of being tied down to the New Delhi office. From time to time additional personnel were brought in to the office to carry out special assignments while, at the same time, the officers of the Preventive Medicine Section made frequent and extended tours of investigation in the Theater.

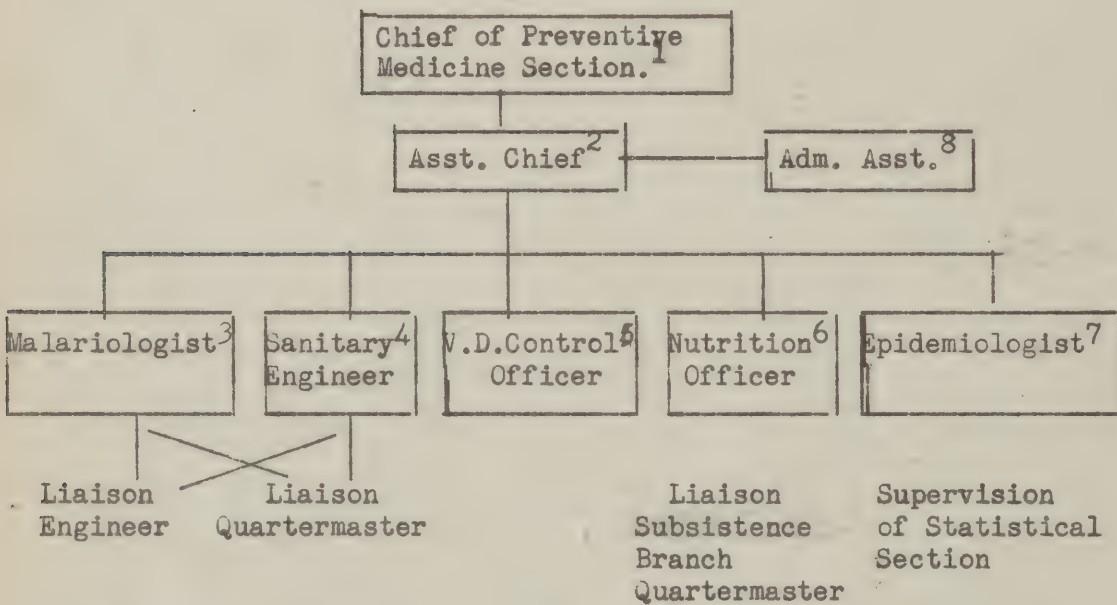
Thus, by November 1944, a well-developed staff to deal with preventive medicine was available at the top levels of administration. Specialists were on hand to deal with specific problems. They worked closely with other staff sections, such as the Engineers or Quartermasters, on technical matters of construction, maintenance, and supply, and devoted a major portion of their time to developing the administrative and technical measures needed to reduce the high incidence of communicable disease in the Theater. Inspection activities were immeasurably increased by the larger staff with the result that far more information was available concerning conditions in the field, and conversely, field personnel were made aware of the fact that their activities were under scrutiny and that there were capable and interested advisors available to assist them. Reliance upon written directives, which had served in the past for want of better approaches to the preventive problem, was replaced by continuous personal supervision and follow-up.

The unified Theater and SOS medical section, moreover, solved the majority of difficulties which had arisen out of the confusion concerning command and technical channels of authority. In the realm of malaria control, the fact that SOS had malaria control personnel assigned to it, while Theater had the Malariaologist and most of the other preventive medicine personnel made little or no difference since all members of the staff were unified under the direction of the Deputy Theater and SOS Surgeon. Communications, directives, and command letters were issued by the same individuals, and only the letterhead and signature differed depending upon whether it was necessary to invoke Theater or SOS authority in

order to obtain action. Reports and records, also, were consolidated so that administrative delays attending communication through two headquarters were abolished. Even the formalities of preserving the identity of the two staff sections was made unnecessary in May, 1945, when the Services of Supply was absorbed into a single Theater command.⁵⁵

The organization of the section is shown below in Table I as are also the general functions of the various specialist personnel assigned during the period November 1944 to December 1945 when, by the natural attrition of demobilization it was reduced to one officer.

TABLE I
PREVENTIVE MEDICINE SECTION
OFFICE OF THE SURGEON, HQ USF IBT



1. Col. Karl R. Lundeberg	MC	Nov 1944	Sep 1945
Lt. Col. Howard A. Vanauken	MC	Sep 1945	Dec 1945
2. Lt. Col. John W. Regan *	MC	Nov 1944	Jul 1945
3. Maj. Sidney W. Scorse	MC	Sep 1944	Feb 1945
Maj. Maurice Seltzer	MC	May 1945	Jun 1945
4. Maj. Gilbert R. Frith	SnC	Feb 1944	Jun 1945
Capt. Roman J. Schliekelman	SnC	Jul 1945	Nov 1945
5. Capt. Malcolm A. Bouton	MC	Oct 1942	Jan 1945
Capt. Preston R. Clark	MC	Dec 1944	May 1945
6. Capt. Carl J. Koehn	SnC	Oct 1944	Oct 1945
7. Maj. Kirk T. Mosley	MC	Apr 1944	Jul 1945
Maj. Ira D. Hirsch	MC	Sep 1945	Present
8. Lt. George P. Myers	MAC	Mar 1945	Nov 1945

* Chief of Section August 1944 to November 1944

TABLE I (Continued)

1. Chief, Preventive Medicine Division (3301)

Organizes and directs the Theater Surgeon's preventive medicine program; coordinates civil and military health matters; advises the Theater Surgeon on all health measures pertaining to the command; maintains liaison with Allied military and civil health authorities; initiates correspondence necessary to correct or supplement health activities; prepares written analyses interpreting data contained in medical reports; directs and coordinates the work of the epidemiologist, malariologist, nutrition officer, medical inspector, sanitary engineer, and venereal disease control officer. Surveys the adequacy of health and sanitary conditions in areas where troops are operating or quartered; as Theater Medical Inspector makes special inspections and investigations of health and sanitary conditions within the command.

2. Assistant Chief of Preventive Medicine Division (3301)

Is the Assistant Medical Inspector and in the absence of the Chief acts as Chief of Preventive Medicine activities.

3. Malaria Control Officer (3005)

Initiates and directs control measures to combat malaria; is consultant in matters pertaining to mosquito control; makes or initiates inspection of areas in which troops will be operating or quartered. Coordinates the work done by malaria survey teams and malaria control detachments; maintains liaison with and advises QMC and C. of E. on supply requirements and aids in procurement and distribution of anti-malarial equipment and supplies. Maintains records and statistics on incidence and control measures relative to malaria.

4. Sanitary Engineer (7960)

Advises on general sanitation problems within the Theater and recommends the employment of specific sanitary measures to protect the health of military personnel; investigates and supervises water supplies, disposal of sewage and refuse, insect and rodent

TABLE I (Continued)

control, sterilization of clothing and the sanitation of living quarters; determines equipment needed and projects to be instituted to maintain or improve environmental sanitary measures within the command; acts as liaison officer with Supply Section of Theater Engineer office in matters dealing with Engineer sanitation equipment and operations; renders technical advice on installation and maintenance of sanitary equipment, water and water disposal plants, drainages, spraying, and other sanitary facilities and control measures and advises the Personnel Section on employment of Sanitary Corps officers.

5. Venereal Disease Control Officer (3155)

Initiates and directs measures to prevent venereal disease and advises medical staffs and other officers on various phases of prevention and control. Coordinates activities of military and civilian governing authorities in elimination of prostitution and prevention of venereal disease; instructs military personnel in proper administration of prophylaxis and inspects Army Prophylactic stations; investigates sources of infections and recommends control measures. Supervises treatment, maintains liaison between unit commanders and treating agencies; determines whether or not Army Regulations are being followed. Maintains statistics and prepares reports.

6. Nutrition Officer (3316)

Advises on matters pertaining to food and nutrition as they affect the health of military personnel within the Theater. Studies rations and mess operations, including the selection, distribution, preparation, and serving of food, as they affect the health of the troops; makes recommendations for the correction of defects or deficiencies, and as to the need of vitamin supplementation of the diet; prepares data on food preparation, nutritive value of foods and adequacy of rations; surveys messes; cooperates with the Quartermaster Corps in an advisory capacity on nutritional matters; assists in instruction of personnel in regard to nutrition and attainment of adequate dietary standards. Reports dietary deficiencies found during nutritional surveys and makes recommendations regarding the levels of intake of specific nutrients and measures to preserve food values necessary to correct

TABLE I (Continued)

these deficiencies and maintain the nutritional status of troops at an optimal level; provides liaison with the Quartermaster and aids in the instruction of personnel in Nutrition.

7. Epidemiologist (3119)

Determines the incidence of communicable diseases in troops and, when indicated, in adjacent civilian communities, and investigates all unusual prevalence of such diseases. Formulates and keeps such epidemiological and statistical charts and reports as will show health conditions and the incidence of disease in the Theater.

8. Administrative Assistant (2120)

Supervises personnel in performance of such duties as preparation and maintenance of records and special reports; acts as liaison officer with other Theater staffs; screens routine sanitary reports for problems requiring action by the Theater Headquarters; acts as coordinator and administrative assistant for special scientific commissions working in the Theater.

End of Table I

The program of work laid out for the reorganized Preventive Medicine Section was based largely on the recommendations of the Kelser Mission which had been sent out by the War Department, 1 October 1944, to study certain personnel and veterinary problems and to investigate the high sick rates in C-B-I Theater. The mission reported its findings and recommendations to the Commanding General, C-B-I Theater on 9 November 1944⁵⁶ and at the request of the Surgeon, one of its members was assigned to duty in the Theater as Chief of Preventive Medicine and Theater Medical Inspector.

The test of an organization's qualities is the results it obtains. By applying this test it is possible to discern that it was only late in 1944 that a preventive medicine organization was available in the Theater which could produce a substantial reduction in the incidence of disease. Certain qualifications are necessary to this observation. In considering the organization, one must include not only the specialists at the upper levels of authority, but the field organizations primarily engaged in preventive work. The number of malaria control and survey units in the Theater rose from none in 1942 to 32 at the peak in 1944 and early 1945 (excluding those assigned to China Theater). The cumulative effects of sanitary engineering and environmental mosquito-control measures must be recalled in reviewing the statistics on disease in 1945, which were so markedly lower than the rates for previous years. The fact that suppressive atabrine treatment was used among combat troops during 1944, and in all troops stationed in hyperendemic areas in 1945⁵⁷ must be listed as an important cause in the reduction of clinical malaria, since it prevented recurrences in already infected persons. Finally, it must be borne in mind that after March 1945 troops were not engaged in combat, and some of the most dangerous areas (including the foci of scrub typhus) were gradually evacuated or changed from bivouac areas to semi-permanent type garrisons.

However, it must be recognized that without the more elaborate organization, stair-stepped so that agencies existed at all echelons of command and administration, few of the changes noticeable in 1945 could have occurred. The enforcement of command discipline in regard to malaria control, the awakening of interest in water sanitation, use of impregnated clothing in areas where the vector of scrub typhus was to be found, control of certain danger zones in the civilian area, such as restaurants, air spraying with DDT, coordination of effort on troop movements--these and many other aspects of prevention could not be instituted without the presence of trained and energetic specialists who could carry out not only the necessary operations and plan successive steps in a unified program, but, through the contacts which they made with command and with other staff sections, publicize, educate, advise, inspect, and, finally convince all troops and troop leaders of the importance of prevention. The development of such a program, the inspection, education, and follow-up work which was required was time consuming and, as indicated by the experience in the Theater, could not be carried out by a single surgeon. Assistants were needed who could devote their primary attention to specific problems and who could work both in the field and in rear echelon headquarters directly with the other staff members whose assistance or support was required.

A second observation is that the coordination of effort and the simplicity of organization are required to obtain the maximum value from available preventive medicine facilities. This necessity is particularly true, when, as is frequently the case, personnel is insufficient to provide all echelons with complete staffs which can carry out delegated responsibilities. Delegation of responsibility to a subordinate element without also providing that element with staff specialists is fruitless; likewise, maintenance of responsibility at an upper administrative level, but leaving specialists in a subordinate echelon, is uneconomical. Sooner or later, unity must be obtained in order to produce uniform, direct, clear, and decisive action.

In July 1944, the Theater Surgeon was called upon to explain why present disease rates--particularly those for malaria and diarrheal conditions--were so much like those of previous years, instead of showing marked improvement. In replying, he noted that although malaria rates were much the same as those in 1943, they were lower than those estimated for 1944, and he listed more extensive environmental control, more malaria units, and the use of DDT as measures to be taken in the future.

On the question of diarrhea and dysentary, however, the Surgeon challenged current personnel, organizational, and command policies which were then in effect. First, he pointed out that in order to secure more adequate inspection of foodstuff at its source, whether locally procured or in storage prior to issue, additional Veterinary Corps troops were needed, and that this need, and a proposed organization for using the troops, had been submitted at an earlier date. Second, he attacked vigorously the general practice of using native personnel in unit messes as food handlers. Realizing the many objections which would beset the policy of using only American personnel for such duties, he nevertheless insisted that other preventive measures would be only palliative as long as contamination was permitted during preparation of food. And third, noting that sanitary inspectors in the field seldom were strict enough, he suggested that the addition of a Sanitary Inspector to the Theater Surgeon's office who would, in effect, inspect the local inspectors as well as the messes and areas would improve the defect.

The matter was closed by dismissing the recommendation that natives be no longer used as food handlers as "impractical" and "impossible under present troop basis". The Theater Surgeon was instructed instead to submit a short letter on the subject of sanitation. This action was carried out and commanders were warned to place greater emphasis upon sanitation in order to curb the incidence of diarrheal disease.⁵⁸

In contrast, nearly a year later-- after the preventive medicine staff had been augmented and its members had been in contact for several months with field and headquarters authorities-- a summary of statistics on disease in the Theater was again noted by the Theater Commander. The notes of his Deputy and his own expression of approval-- "Splendid"-- summarized what had been accomplished and how it had been done. Wrote the Deputy Theater Commander of the report on the health of the command:

"It indicates what can be done by a combination of medical and command methods. The medicos establish the medical grounds for action and the C.O. of any unit whose rates start climbing received a letter from this Headquarters asking for an explanation. The special consultants from the Surgeon's office watch these charts and when any disease starts climbing they immediately hop on it. The steady improvement in the health of the Theater I attribute largely to vigorous work by [the Surgeon] who takes direct action rather than issuing circulars and directives."⁵⁹

This note in effect seemed to respond to the statement made by Colonel R. P. Williams, Theater Surgeon, in August 1944:

"Good public health is, within limits, a purchasable commodity and the results obtained will be proportionate to the numbers and quality of the personnel employed and the amount of material that is expended."⁶⁰

The experience of the Theater indicated that the exploitation of agents for preventive medicine--personnel and supply--was dependent upon good organization of the medical service. The availability of those means was dependent upon command approval and support.

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REFERENCES

1. Radio and mail service was established between the two Headquarters, but the former means of communication was necessarily brief and terse, while the latter invariably allowed delay, particularly when an interchange of correspondence was necessary to complete the transaction at hand. Weekly letters were sent forward from the Rear Echelon Medical Section, covering current business and supplementing more urgent communications, but a glance at the files containing the correspondence indicates the disadvantages of the system, the growing necessity for independence at Rear Echelon, and yet, at the same time, the continuing need for the Theater Surgeon, in Forward Echelon, to maintain final control. SOS was invariably caught in the middle. (See Surgeon's File 321.1 Outgoing and Incoming, 1943-44).

2. "A History of Med. Dept. Activities in India" (Colonel John M. Tamraz, MC) p. 43. (Hereafter cited as TAMRAZ DIARY) (Surgeon's Historical Files (SHF)).
3. See reports of sanitary and malaria control officers (U.S.P.H.S.) in the field, and periodic reports of the Senior Surgeon, P.H.S., attached to the office of the Surgeon, S.O.S. (Surg File 319.1 Anti-Malaria Reports, and Malaria Survey Reports, 1942-43).
4. Ltr, India Hq United States Armed Forces, China Burma India (USF CBI), 14 July 1942, "Command Relationships at Ramgarh Training Center," from Maj. Gen. F.C. Sibert to CO USAF, Ramgarh; Ltr, Branch Office Hq American Army Forces CBI, Office of the Surgeon, 25 July 1942, "Medical Responsibilities, Ramgarh" from Surgeon, USAF CBI to Surgeon USAF Ramgarh (Both citations in Surg File 312.1 Outgoing 1942).
5. The consolidation of the staffs of the Theater and S.O.S. Surgeons on 22 August 1944, which was carried out to achieve economy in personnel as much as to unify effort, brought about this pooling. Air Force still retained a separate but subordinate medical section. Ltr, Hq USAF CBI Office of the Surgeon, 13 September 1944, from Surgeon, USAF to S.G.O.; Ltr, Hq USF IBT Office of the Surgeon, 14 November 1944, "Conservation of Personnel" from Surg USF to G-3 USF (Both citations in Surg File 312.1 Outgoing 1944).
6. "Notes from the Diary of Col. Robert P. Williams," p.1. (SHF Burma); "Medical Plan", Col. R.P. Williams, M.C., Hq American Army Forces, CBI, Maymyo, 27 March 1942. (Miscellaneous Documents pertaining to the 1st Burma Campaign, p. 3-5; hereafter cited as MISC. DOC.) (SHF Burma).
7. TAMRAZ DIARY, p. 5, 7-9, 15
8. Memorandum, 16 October 1941, from Executive Officer, Medical Commission to Burma-Yunnan Railroad to Mr. Lauchlin Currie, Administrative Assistant to the President; Radio No. 35, 10 April 1942, from Chief, American Mission to China to CG American Military Mission to CBI; Radio from CG American Military Mission to CBI (Undated - 6/211 April 1942) to Chief, American Mission to China; Ltr, 15 April 1942, from Surgeon Hq Chinese Expeditionary Force to Burma, Maymyo, to Chief, American Medical Mission (to Yunnan-Burma Railroad); Ltrs, 21 April 1942, from Chief, American Medical Commission to the Yunnan-Burma Railway, Lashio, to C/S, Hq C.E.F. (MISC. DOC. p. 12-16, 49, 51); Memorandum, 11 June 1942, Hq USAF CBI from C/S USAF to CG SOS USAF CBI (SHF 319.1 Anti-Malaria Reports).

9. Summaries of the activities of the S.O.S. Surgeon, and the Senior Surgeon and his assistants of the U.S.P.H.S. are given in Memoranda, 27 June, 4 August and 30 September 1942, "Malaria Control and Sanitation among U.S. Troops in India, present status," "Malaria Control and other activities of the U.S.P.H.S. Officers on duty with the India-Burma-China Forces - to the end of July 1942", and "Malaria control among the American Forces in India during the summer of 1942" from Lt. Col. Victor H. Haas, P.H.S. to Surg. S.O.S. (Surg File 319.1 Anti-Malaria Reports, and 710 Malaria). Status and progress reports from officer in the field, reports of surveys of new installations, reports on sanitary and malaria control programs, and similar material presenting the details of the sanitary programs are to be found in the same file, in Surg File 319.1 Malaria Survey Reports, and Surg File 710 Malaria. An illustrative note on the handling of supplies is found in Memoranda, Hq SOS USAF CBI 6 and 10 August 1942, "Serious Shortage of Pyrethrum Extract", and "Pyrethrum" from Surg SOS to C/S SOS (Surg File 441 Medicines).
10. Ltr, Hq Base Section No.1, S.O.S., 18 June 1942, "Status of Sanitation and Anti-Malaria Measures" from Base Anti-Malaria Officer to Surgeon Base Sec 1. (Surg File 319.1 Anti-Malaria Reports).
11. Ltr, Branch Office Hq USAF CBI, Office of the Theater Surgeon, 24 September 1942, from Theater Surgeon to Dr. Brian R. Dyer, All-India Institute of Hygiene and Public Health, Calcutta (Surg File 710, Malaria).
12. Correspondence of U.S.P.H.S. officers and S.O.S. Surgeon in Surg File 319.1 Anti-Malaria Reports.
13. Memorandum, Hq SOS USAF CBI, 5 July 1942, "Anti-Malaria Measures", from Surg SOS to Hq USAF CBI (Surg File 710, Malaria).
14. Ltr, Branch Office Hq American Army Forces CBI, 5 August 1942, "Health Measures" from CG USAF CBI to CG's SOS, 10th AF, and CO's Ramgarh Training Center and US Army Tank Det, Ahamednagar (Surg File 700, Medicine, Hygiene & Sanitation). Other headquarters published similar directives; Memorandum, Hq US Air Forces in India & China, 10th US Air Force, 25 July 1942, from CG 10th AF to all personnel 10th AF in New Delhi (Surg File 720, Health); Memorandum No. 8, Hq Base Section No. 1, SOS, Office of the CO, 9 June 1942, "Anti-Malaria Measures for US Forces in Base Section No. 1". The directive published at Ramgarh Training Center was the only one outlining in detail the

organization and administration of the sanitary program. Here, a sanitary supervisor was to be appointed and sanitary inspectors selected for each camp area. The latter officers, with anti-malaria squads furnished by local troop units, were to supervise and carry out sanitary measures, report to the sanitary supervisor who, in turn, would report to the local Public Health Officer. It is to be noted that this organization in effect made the P.H.S. Officer the top link in the chain, although he was theoretically only an advisor to the local commander. (Memorandum, Post Hospital, Office of the Sanitary Department, Ramgarh, 12 September 1942, "Duties and Responsibilities of American Personnel assigned to Sanitation and Malaria Control" (Surg File 200.3 Personnel)).

15. TAMRAZ DIARY, p. 52, 83
16. TAMRAZ DIARY, p. 52; Ltr, India Hq USAF CBI Office of the Surgeon, 2 July 1942, "Venereal Disease Control", from Asst. Theater Surgeon to CG, Rear Echelon, Hq USAF CBI (Surg File 726, VD 1942-43)
17. TAMRAZ DIARY, p. 44, 141; Surg File 331.4 "Messes" contains the series of reports on the nutritional status of troops at stations in India and China.
18. See section below on Nutrition; Memorandum No. 5, Hq SOS USAF CBI 15 January 1943 "Vitamin Concentrates" authorized the issue of one tablet per man per day when a medical officer or nutritionist had certified that the ration was deficient in vitamins.
19. Special Order No. 159, Hq SOS USAF CBI, 30 November 1942.
20. TAMRAZ DIARY, p. 99, 119; Memorandum, Hq SOS USAF CBI, Office of the Surgeon, 26 December 1942, from Maj. William A. Brumfield, M.C., to CG SOS USAF CBI (Surg File VD 1942-43).
21. Special Order No. 66, Rear Echelon, Hq USAF CBI, 31 March 1943.
22. The allotment of personnel, however, was not entirely a matter which could be decided locally, since it was in turn based upon a War Department authorization. Personnel shortages existed everywhere and it was a question of stretching the allotment as far as possible rather than simply filling vacancies wherever and whenever they existed. However, this question of personnel for preventive medicine activities will be discussed more fully later on in the text. For command letters

- to units with poor or commendable VD rates, see Surg File 721.1 VD. Ltr, Rear Echelon Hq USAF CBI, 9 April 1943, "Venereal Disease Control," from CG USAF to Major Commands, outlines command responsibility and VD control measures. (Surg File 726.1 VD).
23. TAMRAZ DIARY, p. 98, 113; Ltr, 30 September 1942, "Supplies and Equipment required for Malaria control among American Forces in India-Burma-China for the Calendar Year 1943" from Senior Surgeon, USPHS to Surgeon SOS; Ltr, Hq SOS USAF CBI Office of the Surgeon, 5 October 1942, "Supplies and Equipment needed for malaria control in 1943" from Surg SOS to C/S SOS; Ltr, same Hq, 27 October 1942, "Additional equipment needed for malaria control among American Forces for 1943," from Surg SOS to CG SOS; Ltr, Hq SOS USAF CBI, 6 November 1942, "Supplies and Equipment needed for Malaria Control in 1943," from Surg SOS to C/S SOS; Ltrs, Hq SOS USAF CBI, 7 and 17 November 1943, same subject, from CG SOS to CO Base Section No. 1, SOS, Karachi. (Surg File 710 Malaria).
 24. Ltr, Rear Echelon Hq USAF CBI Office of the Theater Surgeon, 18 December 1942, "Anti-Malaria Campaign" from Assistant Theater Surgeon to Surg SOS (Surg File 300.6, Malaria Directives).
 25. Check-Slip, Hq 10th Air Force, 13 December 1942, from Surg 10th AF to Theater Surg; Check-Slip, Hq SOS USAF CBI, 23 December 1942, "Requisition for Malaria Control Supplies," from Surg SOS to Surg 10th AF (Surg File 710 Malaria).
 26. TAMRAZ DIARY, p. 75, 112, 113, 114; Ltr, Hq SOS USAF CBI, 14 December 1942, "Transfer of Medical Officer" from CG SOS to CG USAF CBI (Surg File 210.3 Transfer of Officers); Radio TP 709, 21 December 1942, from Hq USAF CBI to SGO WD (AG Radio File); Radio TA 806, 23 Jan 1943 from Hq USAF CBI to TAG WD; Memorandum, Hq SOS USAF CBI Office of the Surgeon, 12 February 1943, "Malaria Control Units," from Surg SOS to CG SOS (Surg Secret File 1942-1943).
 27. Ltr, Hq SOS USAF CBI Office of the Surgeon, 1 January 1943, "Plan for Malaria Control, CBI Theater, 1943" from SURG SOS to Theater Surg (Surg File 710 Malaria); Ltr, Rear Echelon Hq USAF CBI, 9 January 1943, "Malaria Control" from CG USAF CBI to commanding generals, major commands (Surg File 300.6 Malaria Directives).
 28. Radio No. 157, 28 January 1943, from WD to CG USAF CBI (AG Radio File); "Annual Report of Medical Department Activities...For the Year 1943," Section III, sub-section IV "Malaria Section," p. 1 (SHF Theater Surgeon).

29. TAMRAZ DIARY, p. 156
30. Memorandum, HQ USAF CBI Office of the Theater Surgeon, 26 June 1944, "Critical Analysis of the Organization of Malaria Control in the CBI Theater" from Theater Malariaologist to Surg SOS (Surg File 370.5, Movement of Malaria Units).
31. Memorandum, Hq USAF CBI Office of the Theater Surgeon, 9 March 1943, "Theater Malaria Control" from Theater Malariaologist to CG Rear Echelon Hq USAF CBI (File 300.6, Malaria Directives).
32. Circular No. 5, Rear Echelon Hq USAF CBI, 8 April 1943, "Malaria Control" (Surg File Theater Circulars).
33. Circular No. 42, Rear Echelon Hq USAF CBI, 7 August 1943, "Theater Directive on Malaria Control" (Surg File Theater Circulars).
34. This directive, prepared by the Assistant Theater Surgeon in Rear Echelon Headquarters (where the Theater Malariaologist was assigned) evoked critical comment from the Theater Surgeon, at Forward Echelon, on the ground that the added jurisdiction given S.O.S. Commanders over the malaria control units jeopardized the complete control desired over such units as part of "Theater" rather than S.O.S. troops. However, it was not considered to be a sufficiently important objection to require immediate revision of the Circular: Ltr, Station Hospital APO 466, 31 August 1943, "Cir. 42, Malaria Control Directive" from Theater Malariaologist to Assistant Theater Malariaologist; Check-slip, Rear Echelon Hq USAF CBI, 9 September 1943, "Circular 42, Theater Directive on Malaria Control" from Asst. Theater Malariaologist to AF Rear Echelon Hq USAF CBI (Surg File 300.6 Malaria Directives).
35. Ltr, Rear Echelon Hq USAF CBI, 28 June 1943, "Allocation of Anti-Malaria Supplies in Base Section No. 1, Advance Section No. 1, and Base Section No. 2" from Asst. Theater Malariaologist to Surgeon SOS; Ltr, Rear Echelon Hq USAF CBI, 15 June 1943, "Malaria Control Supply," from Theater Malariaologist to Surg SOS (Surg File 400.3 Distribution of Malaria Supplies).
36. Radio 2057, 15 July 1943, from WD to CG USAF CBI (AG Radio File); Radio AD 1500, 19 July 1943, from CG Forward Echelon Hq USAF CBI to CG Rear Echelon Hq USAF CBI. To insure compliance with the War Department's advice, the Theater Surgeon

called for the revision of the malaria control directive of 8 April 1943, stressing command responsibility more clearly. The new directive, issued 7 August 1943, as described in the text, better defined but did not materially change the present control organization.

27. Memorandum No. 112, Hq SOS USAF CBI, 12 July 1943. Items transferred from Quartermaster and Engineer Supply to Medical Supply included Paris green larvicide; diesel oil No. 2; dusters and sprayers of various types; insecticides; and repellents.
28. Ltr, Rear Echelon Hq USAF CBI, 15 September 1943, from Assistant Theater Malariaologist to Theater Malariaologist (File 322 Organization).
29. Radio AL 12, 18 June 1943, from Theater Malariaologist to Deputy Theater Surgeon; Ltr, Hq USAF CBI 3 August 1943, "Malaria Control" from Asst. Theater Malariaologist to Theater Malariaologist (Surg File 322 Organization); Radio 2379, 8 August 1943, from WD SGO to Rear Echelon Hq USAF CBI; Radio AG 1214, 6 August 1943, from Rear Echelon Hq USAF CBI to SGO (AG Radio Files) Ltr, Hq USAF CBI 15 September 1943, from Assi. Theater Malariaologist to Theater Malariaologist (Surg File 322 Organization); Ltr, Hq USAF CBI Office of the Theater Surgeon, 24 October 1943, from Theater Surgeon to Theater Medical Inspector; Ltr, Rear Echelon Hq USAF CBI 4 November 1943, from Theater Medical Inspector to Theater Surgeon; Ltr, Hq USAF CBI Office of the Theater Surgeon, 23 December 1943, from Theater Surgeon to Deputy Theater Surgeon; Ltr, Rear Echelon Hq USAF CBI 1 February 1944, from Acting Theater Malariaologist to Theater Surgeon; Ltr, Hq USAF CBI Office of the Theater Surgeon, Theater Surgeon to Deputy Theater (above five letter citations in Surg File 312.1, Outgoing (from Theater Surgeon), Incoming (to Theater Surgeon), #1); Ltr, Rear Echelon Hq USAF CBI, 2 February 1944, "Malaria Control Organization" from Acting Theater Malariaologist to Theater Surgeon (Surg File 701 Med Attendance).
40. TAMRAZ DIARY, p. 156, 158. This officer reported for duty 8 March 1943.
41. Annual Report of Medical Department Activities... For the year 1943" Section III, Sub-section I, "Office of the Theater Surgeon, Rear Echelon," p. 1, and Sub-Section IV, "Malaria Section," p. 1-2, (SHF Theater Surgeon). Colonel E.M. Rice was later awarded the Legion of Merit for his service as Theater Malariaologist (5 February 1943 to 17 November 1943) (GO 187, Hq USF IBT, 31 August 1943). The recommendation for this award

read in part: "Colonel Rice reorganized the anti-malaria service and developed our present efficient technique of area mosquito control using malaria survey and control units sent out from the States. As Theater Malariaologist Colonel Rice drew up long range plans for malaria control throughout the C.B.I. Theater. He selected and ordered the proper equipment and supplies. He convinced commanding officers and supply agencies that anti-malaria supplies must have priority equal to that of other weapons if a military organization is to hold its own in hostile territory. Colonel Rice was a tireless worker, travelled a great deal in order to inspect and advise all aspects of the widely scattered malaria control activities of the Theater. He maintained close liaison with British and Indian workers adapting and modifying their techniques to American conditions as well as demonstrating to allied malariologists the superiority of many American techniques. His influence continues to be felt...." (Ltr, Hq USF IBT Office of the Surgeon, 16 August 1945, from Surgeon IBT to CG USF IBT (Surg File 201-Rice, E.M.)

42. TAMRAZ DIARY, p. 231, 233; "Annual Report" cited above, Section III, Sub-Section I, p.1.
43. Ltr, Rear Echelon Hq USAF CBI, 20 October 1943, from Theater Medical Inspector to Theater Surgeon (Surg File 312.1 Incoming #1).
44. Ltr, Hq USAF CBI Office of the Theater Surgeon, 27 August 1944, from Theater Surg to CG Z-Force Operating Staff; Ltr, Hq USAF CBI Office of the Theater Surgeon, 29 August 1944, from Theater Surgeon to Surgeon Y-Force Operating Staff (Both citations in Surg File 312.1 Outgoing #1).
45. See Circular No. 1, Hq USF IBT Office of the Surgeon, 1 January 1945, for listing of directives affecting the Medical Department in the Theater.
46. Ltr, Hq USAF CBI Office of the Theater Surgeon, 11 October 1943, from Theater Surgeon to Deputy Theater Surgeon; Memorandum, Hq USF CBI Office of the Theater Surgeon, 17 December 1943, "T/O Theater Surgeon's Office, Hq USAF-CBI" from Theater Surgeon to G-1 Hq USAF CBI; Memorandum, Hq USAF CBI Office of the Theater Surgeon, 26 December 1943, same subject, from Theater Surgeon to G-1; Memorandum, Rear Echelon Hq USAF CBI, 23 February 1944, "Allotment for Theater Headquarters" from Deputy C/S Rear Ech Hq., USAF to all Staff Sections (Surg File 200 Personnel 1942-44); Memorandum Hq USAF CBI Office of the Surgeon

- 4 June 1944, "Duties of Personnel of Surgeon's Office, Hq USAF CBI" (Surg File 200 Personnel 1942-44).
47. Circular No. 3, Rear Echelon Hq USAF CBI, 9 January 1944, "Anti-Malaria Control."
48. TAMRAZ DIARY, p. 314.
49. Circular No. 223, War Department, 1943; Ltr, Rear Echelon Hq USAF CBI, 22 October 1943, from Theater Malariaiologist to Theater Surgeon; Ltr, Hq USAF CBI Office of the Theater Surgeon, 1 November 1943, from Theater Surgeon to Theater Medical Inspector (Surg File 312.1 Ltrs from and to Theater Surgeon, #1); Ltr, Rear Echelon Hq USAF CBI, 1 February 1944, from Acting Theater Malariaiologist to Theater Surgeon; Ltr, Rear Echelon Hq USAF CBI, 22 January 1944, "Four-Hour Course of Malaria Instruction" from Theater Surgeon to Asst Theater Malariaologists (Above four citations in Surg File 312.1 Ltrs from/to Theater Surg I); Ltr, Rear Echelon Hq USAF CBI, 19 February 1944, file 720 (19 Feb 44)7, "Four Hour Course of Instruction on Malaria and its control" from CG USAF to all major commands (Surg File 720 Malaria II).
50. Check-Slip, Rear Echelon, Hq USF CBI, 13 March 1944, "Malaria Control Reports," from Acting Theater Malariaiologist to Theater Surgeon (Surg File 008 Policies); Memorandum, Rear Echelon Hq USAF CBI Office of the Theater Surgeon, 11 March 1944, "Special Staff, Rear Echelon Headquarters" from Theater Surgeon to G-4, (Surg File 008 Policies).
51. Circular No. 36, Rear Echelon Hq USAF CBI, 1 April 1944, "Malaria Control Directive;" Check-Slip, Rear Echelon Hq USAF CBI 28 March 1944, "Transfer of Ass't Malariaologists and Malaria Units" from Theater Surgeon to Surgeon SOS; Check-Slip, Rear Echelon Hq USAF CBI 26 March 1944, "Reassignment of Malaria Units" from Theater Surgeon to AG Rear Echelon Hq USAF (Surg File 370.5 Movement and Operations).
52. Ltr, Hq AAF, India Burma Sector CBI, 26 April 1944, "Malarial Control Directive" from CG AAF to CG USAF CBI; Check-Slip, Hq SOS USAF CBI, 1-11 May 1944, "Malarial Control Directive" circulated between Surgeon SOS and Theater Surgeon (Rear Echelon) (Surg File 710 Malaria II); Inclosure #3 to Ltr, Hq USAF CBI Office of the Theater Surgeon, 15 May 1944, "Essential Technical Medical Data from Overseas Forces," from Theater Surgeon to The Adjutant General WD (Attn: SGO) (Surg File 350.05). Ltr, Hq SOS USAF CBI, 10 April 1944, file SOS 725.11 "Malaria Control" from CG SOS to major SOS commands (Surg File 710 Malaria II); Memorandum, Hq USAF CBI Office of the Theater Surgeon, 26 June 1944, "Critical Analysis of the Organization of Malaria Control in the CBI Theater" from Theater Malariaiologist to

Surgeon SOS (Surg File 370.5 Movement Malaria Units).

53. General Order No. 104, Hq USAF CBI, 22 August 1944.
54. "History of the Medical Department, Services of Supply, India Burma Theater 24 October 1944 to 20 May 1945," p. 76, 79-80 (SHF SOS Surgeon).
55. General Order No. 95, Hq USF, IBT, 15 May 1945. The change became effective 21 May 1945.
56. Ltr, Hq SOS USF IBT, 9 November 1944, "Report of Medical Department Mission" from Raymond A. Kelser, Brigadier General, USA, et. al., to CG USF IBT (Surg File 319.1 Reports Misc).
57. Check-Slip, Hq USAF CBI, 30 August 1944, "Repressive Treatment Continued" from Theater Surg to G-1, G-3, G-4, and AG, Hq USAF (Surg File 710 Malaria II); Circular No. 11, Hq USAF CBI, 31 January 1945.
58. Memorandum, Hq USAF CBI, 1 August 1944, from Deputy Theater Commander to C/S and Theater Surgeon; Memorandum, Hq USAF CBI, 4 August 1944, from Theater Surgeon to Deputy Theater Commander; Ltr, Hq USAF CBI, 12 August 1944, file 710 (12 Aug 44) 13, "Diarrheal Diseases" from CG USAF to all commands (Surg File 710 Disease II).
59. Memorandum, Hq USF IBT, Office of the Surgeon, 14 May 1945, "Health of IBT for the Week Ending 4 May 1945" from Surgeon to CG USF (File 720 Health).
60. Memorandum, Hq USAF CBI, 4 August 1944, from Theater Surgeon to Deputy Theater Commander (Surg File 710 Diseases II).

✓ 2. Activities of the United States Public Health Service Group (1941 to 1943)

In September 1941, Headquarters of the United States Public Health Service Medical Commission to the Yunnanyi-Burma Railway was established at Lashio, Burma. This commission was appointed by the President of the United States and accredited to the Chinese National Government. The mission of this group was to establish and supervise a complete medical and sanitation service for the quarter-million Chinese laborers engaged in the construction of a railway from the China-Burma border to Kunming. One of the most important phases of this work, and certainly the largest, was malaria control. For this reason the Commission was composed of four medical officers, six sanitary engineers, three entomologists and two administrative officers.

The critical supply situation in the United States, the lack of adequate shipping facilities, the closing of the Pacific route on 7 December 1941 and the sealing of the Port of Rangoon by the Japanese in February 1942, all contributed to a delay in getting an efficient program under way. However, by 1 April 1942, hospital and dispensary service, utilizing Chinese personnel, had been organized and malaria control and general sanitation programs had been instituted throughout the first two divisions of the railway which traversed the main malarious areas. The Japanese sweep into Central and North Burma necessitated withdrawal from Lashio on 25 April 1942 and by 1 May 1942 the Japanese threat to all of Burma and Western Yunnan forced withdrawal of all personnel from the first two divisions. The members of the Commission were therefore concentrated in Kunming by 13 May, on which date a radio arrived from the War Department stating that all members of the Commission had been detailed to the War Department, effective 27 April 1942, for duty with the military mission to China. With the exception of one medical officer who remained in China, the remaining members were assigned by General Stilwell to Headquarters Services of Supply, China-Burma-India Theater at New Delhi.

Upon reporting to that Headquarters, they were theoretically assigned to the office of the Surgeon. However, urgent need for engineers in the construction of airfields, scattered throughout India from Karachi to Chabua, necessitated the assignment of most of the engineers to construction duties with sanitation as a secondary duty. The Chief of the Commission, Lt. Col. Victor H. Haas, became in effect the first Chief of Preventive Medicine and Malariaologist for the Theater. At the larger U. S. Army installations the Chief Sanitary Engineer undertook general sanitary surveys while the Entomologists immediately began malaria surveys in the more highly malarious areas. In time these surveys gradually became

control program of a sort, insofar as limited personnel and extremely limited supplies permitted. The supplies and equipment necessary for malaria control consisted almost entirely of small quantities of pyrethrum extract, wire screening, Paris green, knapsack sprayers and dusters which had been shipped from the United States for use of the Commission in China but which, after the fall of Rangoon, were diverted to either Calcutta or Karachi. In addition, steps were immediately taken to secure through Medical Directorate G.H.Q. (I) other anti-malarial supplies such as additional pyrethrum, oil, anti-mosquito cream, hand sprayers, etc.

The first malaria control programs were begun at Karachi, Chabua, Bangalore, Agra, and Ramgarh. It cannot be emphasized too strongly that throughout 1942 and well into 1943 "inadequacy" was the outstanding feature of malaria control activities. There was never enough of anything and the prospects of obtaining enough appeared dim in view of the very limited shipping facilities and the small Troop Basis allotted to the Theater.

In Bengal and Bihar malaria control activities were extended to include Gaya, Ondal, Panagrh, Pandaveswar and Calcutta while in Assam activities were greatly increased by the putting into operation of additional airfields in the Chabua area and in Western Assam.

Many U. S. military installations in India, especially air-fields in Bengal and Bihar, consisted of two to four square miles of territory closely surrounded by native agricultural villages and paddy fields. Local economic conditions permitted neither the mass evacuation of these nearby villages nor the conversion of these fields to dry crop cultivation. Thus, from the beginning it was obvious that some extra-cantonement sanitation program was necessary if adequate protection was to be afforded personnel stationed in these areas. It was likewise recognized that the necessary control measures could not be effectively carried out by American authorities in view of the unusual relationship existing between the Central and Provincial Governments, the language difficulties encountered with each area having a different dialect, and the all important problem of religious customs, which, for example, made impossible the spraying of a Moslem home by a squad of GI's. Working through GHQ (I) and the Central Government, the Provincial Governments were contacted and early in 1943 they instituted a program of extra-cantonement environmental and sanitary control around many of our larger installations. This served not only to materially reduce many health hazards but also to release United States Army personnel which would have otherwise been employed in this work. This program consisted

mainly of malaria control activities, at least an attempt to reduce fly breeding, and close attention to the occurrence among these local inhabitants of diseases of epidemiological importance. By these means an outbreak of smallpox or cholera could be checked in its incipient stage. This program was continued until late 1945 when decreased activities incident to the evacuation of the Theater allowed the curtailment and eventual discontinuation of the Provincial Governments' programs.

With the decision to build the Ledo-Burma Road, Headquarters of a new Services of Supply section was established at Ledo and the former Chief of the U.S.P.H.S. Commission was assigned as Section Surgeon. He, with two entomologists, initiated the Army malaria control work in Eastern Assam.

When the War Department announced the organization of Malaria Control Detachments (then designated as units), it was decided to activate four such organizations in this Theater utilizing P.H.S. officers and casual Medical Department enlisted men available within the Theater. This did not prove satisfactory since these officers, attached to U.S. Army from another service, could not assume command duties. As soon as possible they were replaced by officers of the Sanitary Corps flown from the United States. By 1 January 1944 all Public Health Service officers engaged in malaria control and preventive medicine had been returned to the United States.

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3. Development of Laboratory Services in India-Burma Theater.

An integral part of any preventive medicine program is laboratory control of the processes established to prevent disease. Not only are periodic examinations of water, milk, etc., required, but early diagnosis of disease and the detection of carriers will prevent spread of infection. The effectiveness of control methods in use as well as whether such methods are actually being employed may be determined in the laboratory.

In the early days of the Theater no separate laboratory service was available. The hospital laboratories, as they arrived, were able to assume only a limited amount of preventive work arising in their immediate vicinity. Generally they were so occupied with the routine diagnostic work of the hospital that but little attention could be given to purely control measures. Occasional use was made of local British or Indian laboratories for special procedures for which Army equipment was lacking but this was limited for the most part to diagnostic methods.

The first laboratories to arrive in India as separate organizations were the Malaria Survey Detachments. Three such units landed in early 1943¹ to be assigned to areas where the concentration of troops was greatest. They were reinforced by three other survey detachments in late 1943 and early 1944². Two of the units, one from the first group and one from the second, were sent to China, the others being established in India and Burma. These organizations functioned initially by studying the malaria problems locally and making recommendations as to the control measures to be put into effect. Then continued investigation tested the effectiveness of the program. New techniques were recommended as they were developed. Assignment of the detachments to the Sections in the Theater provided for decentralized control and the most effective use of the units by the Section Surgeons who were most familiar with local problems.

It was not until February 1944 that a true "public health laboratory" staffed and equipped to carry out epidemiologic investigations and provide a general diagnostic service arrived in the Theater. At that time the Ninth Medical Laboratory debarked in India. It was assigned³ to Advance Section No. 2 (later Intermediate Section) but it was always understood that the laboratory was to serve the entire Theater. Since housing and laboratory space for the unit were not available, the personnel of the laboratory were, for the most part, placed on detached service with the 111th Station Hospital in Advance Section Number 2 and the 20th General

Hospital in Base Section Number 3 (later Advance Section).⁴ The result was a considerable increase in the quantity of work turned out by these hospital laboratories but it was largely limited to the Sections where they were located. A few epidemiologic surveys were carried out by the laboratory during this period.

In August 1944 the Ninth Medical Laboratory began to function as an independent organization. In accordance with its mission to provide service to the entire Theater all medical installations in China-Burma-India were notified of the opening of the Laboratory.⁵ In addition to diagnostic work requests for sanitary investigations, studies of water supplies, of food handlers, amoebic dysentery, animal epizootics, etc., came in. Results of these investigations were reflected by improved sanitation generally in Intermediate and Advance Sections. The Base Sections were not covered so well because of distance from the Laboratory and unfamiliarity with its capabilities.

Accordingly in February 1945, the Commanding Officer of the Ninth Medical Laboratory was appointed Theater Laboratory Consultant.⁶ All of the hospital laboratories were surveyed, attention being particularly focused on equipment, training of personnel, improvement in the quality of the work being done, and the performance locally of fundamental public health laboratory procedures for the personnel in the area. Improved liaison with the Ninth Medical Laboratory was stressed. Combined with a vigorous policy by the Theater Surgeon, there was a distinct improvement in the quality of the service rendered by the laboratories.

In December 1944 training of laboratory technicians had been started at the Ninth Medical Laboratory. Men were taken in for training at the request of other laboratory officers in hospitals and dispensaries. Following the hospital laboratory surveys the student load was greatly increased due to recommendations of the Laboratory Consultant. Deficiencies in men who had already had some experience were corrected, no attempt being made to teach new technicians. Their standards of performance were greatly improved and their work made more reliable, particularly in parasitology.

In May 1945 another medical laboratory, the 29th Medical Laboratory, arrived in this Theater.⁷ It was assigned the task of investigation of the diarrheas, a problem of continuing importance, in the Calcutta and New Delhi areas.⁸ Some work had been done in 1944 by the Dysentery Commission of the Army Epidemiological Board, but many problems had been left unanswered.⁹ Since some of the personnel of the 29th Medical Laboratory were not required on this research they were used to reinforce hospital laboratories. Periodic reports on the progress of the research were received and are discussed in another section of this history.

Following the end of the war, a rapid evacuation of troops from the Theater began with the volume of laboratory work rapidly decreasing as a result. Laboratory personnel was reduced concurrently, the Ninth Medical Laboratory being the first to suspend operations.¹⁰ Its work was taken up by the 29th Medical Laboratory and the local hospitals. The reduced amount of work made it possible to maintain the standards which had been attained earlier.

In summary, it may be said that laboratory service began on a very modest scale. As personnel and equipment became available more and more work was done, with higher standards insisted on. Part of the general reduction in disease rates experienced in 1944 and 1945 can be attributed to the laboratory service in this Theater.

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4. Special Administrative Problems

Coinciding with the growth of the Theater-wide preventive medicine organization of American Army forces in the Theater were certain ancillary developments which must be discussed to present an inclusive picture. Among these was the development of a strong statistical section in the office of the Surgeon. Prior to the summer of 1944, the consolidation of medical statistics for the Theater had been hampered in the offices of the SOS and Theater Surgeons by the lack of personnel. Only the minimum statistical work required for transmitting reports to the War Department and for keeping abreast of the medical situation was carried out, except on special occasions when a review or status study was needed for some particular purpose. Thus, the Venereal Disease Control Officer surveyed incoming reports to identify units with unusually low or unusually high rates, while the Malariaologist kept a running record of malaria rates. With the development of a larger preventive medicine staff, however, it was necessary to improve the facilities for gathering and consolidating medical statistics. This action was taken during the summer of 1944 under the direction of an M.A.C. officer with a group of enlisted men assigned to the SOS Surgeon's (later, the consolidated) staff, so that by autumn, figures on the incidence of disease were readily accessible for review by interested officers.

Liaison with Civil Authorities

Another matter which received attention in 1943 and touched an extremely important factor in the control of communicable diseases in the Theater was the problem of dealing with civil populations. Unlike other tropical theaters of war, it was impossible in overcrowded India, Burma and China to exclude natives from military areas.¹ Except in Burma, where inhabited areas were temporarily deserted by natives during combat, American troops lived in close proximity to local villages, cities, or civilian labor camps. These areas of dense civilian population were dangerous reservoirs of disease -- from malaria and cholera down to the various "dhobie" dermatitis conditions. Control of disease within the boundaries of American troop areas was difficult; the task of extending sanitary measures to the surrounding civilian areas was impossible.

Civilian labor recruited by the British, Indian, or provincial governments for such projects as the Stilwell Road furnished their own medical service. Because they had more adequate facilities and because of the nature of environmental control measures, United States forces assumed the responsibility for anti-mosquito

measures in labor areas, such as on the Stilwell Road or at air-field construction points. Personal protective methods and discipline were the responsibility of the civilian organization or its British sponsors.²

Likewise, anti-mosquito measures carried out in American troop areas were by agreement with the British and Indian governments extended to include the surrounding area within flight range of the Anopheles. This activity included drainage and larvacing of adjacent breeding areas and the spraying of native habitations when they were within the protected zone. Other measures of civilian sanitation in the vicinity of American (as well as British) troop areas were assumed by the Indian government in an authorization which permitted provincial governments to undertake sanitary projects with certain Central Government funds. Projects calling for an expenditure below Rs.6000 could be undertaken by the provincial governments, while more expensive projects required the authorization from the Central Government. In effect, the United States Army assumed general responsibility for anti-mosquito measures in the extra-cantonment areas and gave such assistance as it could to civilian authorities in the prevention or control of typhoid, cholera, plague and other infectious diseases.³ In practice, the problem of village sanitation was so enormous and the civilian facilities to meet the problem so inadequate that little more than cooperation in planning could actually be accomplished. Thus, in the end, the primary element in the protection of troops from village or city bred disease was the "out-of-bounds" authority supported by sanitary inspection of "in-bounds" areas and habitations (principally restaurants).⁴ The benefits derived from assistance given the American forces was not insignificant and the agreement through which it was carried out was not cancelled until late in 1945, as American troops withdrew from the Theater.⁵

Troop Movements.

Another special problem which caused continual concern was that of protecting the health of troops making troop movements in India. The Theater was hardly open before reports were received from units which had made rail journeys in India that large percentages of the troops were being infected with malaria and dysentery enroute.⁶ This problem was one of the most discouraging of any met in the Theater. In the early period, facilities and supplies for prevention were scarce and debarkation points were poorly organized for the reception of troops. Staging areas were obtained from the British, who supplied quarters and messing facilities, none of which met Army standards for the protection of health. The railway journey was made in slow-moving trains without adequate facilities

for messing enroute, for providing potable drinking water, or for mosquito-proofing the compartments. Lack of fans in the cars made it difficult to enforce the wearing of protective clothing or the use of bednets even if ingenuity could contrive a means of fitting the cars with nets. Scarcity of ice and water and monotony or scarcity of food invited troops to sample the local drinks and foodstuffs offered for sale by natives at every stop, with the inevitable toll of noneffectives due to diarrhea and dysentery.

Upon receiving reports of this situation, the S.O.S. Surgeon recommended that troops be supplied with anti-malaria items and be instructed in precautions necessary to avoid infection.⁷ Continual failure to cope with the situation, however, obviously required more energetic action and definite provisions for carrying out necessary protective measures. During the malaria season of 1943, the matter was reopened and S.O.S. was instructed to open a medical supply sub-depot at the port of Bombay to dispense anti-malarial supplies to all troop units leaving the port by rail. The commanders of Base Sections No.1 (Karachi port) and Base Section No.2 (Calcutta) were given similar instructions. They were instructed to detail a medical officer to contact outgoing troops and to check on malaria education and discipline. A Memorandum was issued by S.O.S. headquarters outlining measures to be taken against malaria during troop movements; this memorandum was to be handed to all troops for informational and educational purposes.⁸

In spite of these and other measures, troops continued to be heavily infected during their overland journeys. Base Section Commanders were frequently reminded of their responsibilities for preparing troops for the rail journeys and as frequently insisted that they were doing all that could be done. Indeed, the continued difficulties were due to the real inconveniences and difficulties of mosquito-proofing the railroad cars, breakdowns in the supply line at intermediate points between the port and the destination, and, perhaps most of all, to the ineffectiveness of discipline and education.⁹

The answer to the problem -- detailed planning, concentration of effort from all services upon improvement of the facilities along the route, thorough education and briefing of troops and commanders, and close supervision -- was not really put into practice until the summer of 1945, when troops started moving by rail from Assam to the port of Karachi - first leg of the home journey. Troops were briefed thoroughly before they commenced their journey with emphasis upon the undesirability of carelessly contracting diseases when they were finally on their way home; Train Commanders and Surgeons were issued the necessary supplies; and points enroute were set up to replenish stocks. Food supplies were improved

(10-in-1 ration being used), and wherever possible, waypoints were provided where hot meals could be served (Lucknow was the major point, since an eight hour delay was involved in shifting from meter to broad-gauge rail). Personnel from the Surgeon's office were designated as inspectors at key points and at the destination to report any unforeseen difficulties and advise local personnel. As a consequence, the first large group of troops -- over 4000 -- arrived with no serious illness; some 27 were hospitalized for minor disorders. Their record was astonishing when it was recalled that early troop movements were considered fortunate if no more than 25% of the troops were infected with malaria or dysentery while en route. The problem was specifically one of protection against well-known hazards. It could never be met fully by any local agency, and until personnel and concentrated effort of all services (including Medical) was obtained, success could not be expected.¹⁰

Medical Intelligence.

Medical intelligence activities were necessarily restricted because of the lack of personnel which could be utilized for such purposes. An important agency in this field was the Joint Intelligence Collection Agency ("JICA") which had medical representatives and whose reports were made available to the Theater Surgeon. A wide variety of material was presented in the periodic reports, including intelligence obtained from Japanese prisoners of war, civilians, and other Allied groups. The 9th Medical Laboratory facilities were utilized for the identification of captured Japanese drugs, and the investigation of special incidents that raised the question of the possibility that the Japanese might resort to "biological warfare."¹¹

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7. Memorandum, 30 July 1942, cited above.
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9. Ltr, Hq 10th Air Force, 27 November 1943, "Malaria Control" from Surgeon 10th AF to Theater Malariologist (Surg File 710 Malaria II); Ltr, Rear Echelon Hq USAF CBI, 1 February 1944, from Acting Theater Malariologist to Theater Surgeon (Surg File 312.1 Incoming #1); Circular No. 27, Rear Echelon Hq USAF CBI, 8 March 1944, "Malaria Control" from CG USAF to all commands; Ltr, No. 98305/A.Mov.A.(i) GHQ (I) QMG Branch, Movements Directorate, 31 August 1944, "Malaria Control - List of 'Safe Harbours' at Railroad Stations in India" from Movements Directorate QMG Br. GHQ (I) to CG SOS; Ltr, Hq USAF CBI, 8 September 1944, file 40112/725.11 from CG SOS to major commands SOS (Both citations in Surg File 710 Malaria II).
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PART II - GENERAL HEALTH MEASURES

II - GENERAL HEALTH MEASURES.

II - HOUSING AND AIR CONDITIONING.

The climate of India is, for the most part, tropical and subtropical. Along the Northern border, where elevations reach several thousand feet, summer temperatures are comfortably low and there is snow in winter. Elsewhere the land is near sea level and lacks the ameliorating influence of mountain ranges or elevated plateaus. The monsoons or prevailing winds break the year up into four unequal seasons. Beginning with the calendar year there are two months of the north-east monsoon which is characterized by generally fine weather with clear days and cool nights. Then follows a period of dry hot weather lasting three months during which there is no general air movement and temperatures arise to high levels. The next period, about four months in extent, is the south-west monsoon season in which there is a general air movement from sea to land, accompanied by heavy rainfall. For the last three months of the year the southwest monsoon recedes, allowing clear weather to return to north and then to southern parts of India.

The accompanying table shows the average temperatures experienced during each of the seasons at stations within the area of U.S. troop activities.

TABLE II - TEMPERATURES IN INDIA

Mean minimum and mean maximum for each season, and extreme temperatures at representative stations in areas of India-Burma Theater occupied by U.S. Army troops. (Field Service Hygiene Notes, India, 1945)

STATION	Mean Seasonal Range			Retreat- ing Mon- soon Oct - Dec	Extremes
	NE Monsoon Jan - Feb	Hot Dry Mar - May	SW Monsoon Jun - Sep		
Karachi	52 - 79	70 - 93	80 - 91	60 - 90	31 - 116
Delhi	50 - 72	72 - 96	80 - 92	58 - 83	33 - 118
Bombay	67 - 83	76 - 88	76 - 85	72 - 88	56 - 100
Calcutta	58 - 80	74 - 93	78 - 90	65 - 82	44 - 108
Tezpur	54 - 74	67 - 84	77 - 89	62 - 80	43 - 98
Mandalay	58 - 87	75 - 100	78 - 94	67 - 88	45 - 114

When high temperature is associated with high humidity as it is during the south-west Monsoon, June to September, the extreme physical discomfort causes considerable deterioration of working efficiency. In order to maintain morale and efficiency, both clothing and housing must be adapted to climatic conditions.

Some troops were fortunate in that they were stationed in base areas where permanent housing was available. In most cases such quarters were built by the British Military or by the Indian government and were leased to the U. S. Army. They were constructed with tile or stone slab roofs, heavy masonry walls, and covered porches which shaded the walls. The ceilings were high and there were small windows near the ceiling which aided in free ventilation. While the construction was excellent for coolness in the

hot summer season, it did not permit easy heating in the cold season. Heating, if any, was from small fire places, but most quarters were unheated. No central heating systems were used in U.S. Army occupied quarters in India.

In areas of excessive summer heat, rooms were frequently equipped with ceiling fans. A system of "air conditioning" similar in principle to the "desert water cooler" was used in locations subject to periods of extreme dry heat (over 110° F.) This consisted of wetting down grass interwoven screens of bamboo which were installed in the open archways of porches and of windows, where porches were absent. These screens were called "khus khus tattis" from the use of khus khus grass to fill in the spaces of the bamboo framework. The air in this way was both cooled and humidified as it entered the buildings. The usual practice was for a coolie "bhisti" to make the rounds periodically, splashing water onto the tatties from a goatskin bag. The tatties were most effective if shifted about the building with the sun and then removed for the night. Some of the permanent cantonment buildings were screened, but in most of them bed nets were used at night for mosquito protection. Cotton netting, the only insect barrier available locally impeded ventilation too much to become popular for use over windows and doors.

Housing in permanent-type cantonment buildings was limited to base areas where such facilities were already available, or where building material, labor, and time were abundant enough for the erection. When quarters assigned to U. S. Army personnel had been previously occupied, a great deal of work was usually required to place them in habitable condition. In almost all base areas permanent-type quarters had to be supplemented by temporary construction or by tentage.

In forward areas troops were quartered in tents or in shelters built from locally procured material. American tents were waterproof, strong, and stood up fairly well under the hot humid conditions which caused ordinary cloth to deteriorate in a few months. However, they were dark in color and poorly ventilated. Under the strong tropic sun they became insufferably hot. They had no floors and no provision for making them insect-proof. To make these tents livable troops usually raised them to full head-room height over a wooden gramework, the walls of which were screened. The original side walls of the tent were used as awnings. The floors were either wooden or cement. These became damp in wet weather if laid directly on the ground.

British tents were used almost exclusively since they were readily available and they were much preferred by our troops. Their outstanding characteristic was their coolness. This was

due to light color of the canvas and to the double construction. They were, in fact, two tents, one within the other separated by a space of about eight inches. The space was open about the eaves on all sides and was ventilated near the top through the outer layer of canvas. These British tents had been designed for desert use and were ideal during the hot dry season. However, during the monsoon they were somewhat less desirable since they leaked with every rain. They also deteriorated rapidly so that after four or five months of use the fabric could not withstand the wear and tear incidental to moving camp. These tents were made mosquito proof by sewing onto the edge of the inner tent a side wall of cotton netting. Instead of using guy lines, a post was placed at each corner of the tent and poles were lashed to these at a height of five or six feet. The edges of the tent top were tied to these poles. The original side walls were either rolled up or extended as awnings while the cotton netting was extended to the floor by the addition of a strip of cloth.

A semi-permanent shelter widely used throughout India was the "basha", a thatch-roofed, grass mat-walled structure erected upon a bamboo framework. These were used as hospital wards, warehouses, and shelters for equipment and working personnel. Due to their light open construction, special provisions had to be made to render the bashas mosquito-proof. A burlap material called hessian cloth was used to cover the walls and to form a ceiling. Windows and doors were protected by draped cotton mosquito netting.¹ That the basha was not entirely satisfactory is indicated by the following statement made in an ETMD report from Rear Echelon, Headquarters CBI Theater, 12 August 1943.

"Bashas, although satisfactory in the dry seasons, have given trouble since the advent of the monsoon. It is not uncommon during the rain and windstorms for pieces of roof to blow off in the midst of the downpour. Bamboo lattice work superimposed upon the thatched roofs obviates the difficulty to some extent. Because of the dampness, brick floors have been installed in most of the bashas in place of bamboo 'splits' formerly used. Some units have been moved into British type monsoon tents elevated upon platforms which appears to be a more satisfactory arrangement during this season. Recommend that consideration be given to the provision of British type (monsoon) tentage for troops serving under monsoon conditions instead of bashas or other native-type structures."

Various types of improvised shelters were erected using whatever materials were at hand. Pieces of canvas or parachute cloth would be stretched over bamboo poles. The mud walls of damaged and deserted villages were utilized occasionally. Discarded parachutes were often used, the center raised by a bamboo pole and the cords staked out as guy lines.

From the experience of this Theater, the type of shelter that would be most generally applicable would be a tent, modelled after the British desert tent, water proofed and mildew proofed, with full head room inside and with mosquito netting side walls. A closely laid wooden floor raised several inches above the ground would be desirable, but any solid floor wood or cement would be satisfactory under the conditions encountered here.

Air Conditioning, hospital

The special requirement of hospitals for air conditioning of their operating rooms (surgery) was recognized as early as September 1942 and efforts were made to provide equipment.² These efforts were evidently not at first successful since the furnishing of air conditioning equipment was still a matter for correspondence nine months' later.³

Air conditioning was used at 20th General Hospital, Ledo, Assam, in typhus fever wards and was considered a favorable factor in the treatment of typhus fever cases. Accordingly, the adoption of air conditioning in one ward of each static hospital was recommended in October 1944. This procedure was carried out generally during the next six months and did a great deal towards ameliorating discomfort of the very ill during the hot season.

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3. Memorandum, Surgeon SOS to Chief Engineer, 5 June 1943, Sub: "Air Conditioning Equipment for Hospitals", lists seven hospitals and states that 10 or 12 more will be in the Theater during 1944, all of which will need air conditioning equipment for operating rooms, heat stroke rooms, etc.
4. Letter, Hq SACSEA to Hq Air Command, SEA, 6 October 44, Subject: "Air Conditioned Wards", describes construction of two types for air conditional wards and advises adoption of air conditioning in one ward each static hospital for treatment of typhus cases.

III - CLOTHING

The wearing of proper clothing is an important factor in the health and comfort of troops. The development of suitable wearing apparel for U. S. troops in the United States has been a slow process. To some extent it has followed trends in civilian clothing.

Changes in type of warfare have brought about certain clothing changes, but often the adoption of new types is long delayed. At one time officers were mounted, but they wore clothing appropriate for riding long after they were dismounted. Medical officers were required to wear boots and spurs up to the middle 30's.

The tendency to adapt the old rather than to adopt the new is so deeply set in human minds that extreme changes are seldom made in the appearance of dress. However, it is often possible to incorporate basic changes and still maintain a semblance of existing designs.

The extreme heat of India is endured by the natives largely through the type of clothing and the way it is worn. A common characteristic of all native clothing is that it is loose, both in weave and in fit. This permits shading from direct sunlight as well as free ventilation.

The American custom of wearing shirt tails inside trousers and keeping the trousers up by close tailoring and a belt is not conducive to comfort and health. The space inside the shirt is unventilated. Perspiration runs down to the waist line where it is soaked up by the lower part of the shirt and by the waist band of the trousers. Here it is no longer effective in cooling the body. The accumulation of wetness in this region frequently results in "prickly heat" dermatitis, and predisposes to fungus infections. It is much more comfortable to wear shirts outside the trousers and this is done by Indians when they wear European style shirts.

An upper garment known as the "bush jacket" and designed on conventional military lines was widely accepted throughout the Theater. Made of porous weave poplin, light twill, or other cotton material, it was tailored with collar folded open, a built-in belt and a full skirt. It was worn in place of a shirt. For day wear the sleeves were often cut short; for evening wear they were full length. Although trousers were usually worn with a belt, the maximum comfort was obtained by wearing loose waisted trousers supported by plastic or light cotton shoulder straps under the bush jacket. Shorts with knee socks were often worn in place of long trousers and ankle socks. These were reported as being very comfortable, especially during the hottest part of the year.

The fabrics used in the standard U. S. Army summer khaki uniform are excellent for general summer wear in temperate climates, but their weight and close weave do not make them ideal for wear in excessive hot weather in the tropics. This deficiency was indicated in an early report from the Theater.

"Our troops are using G.I. summer material which is considerably warmer than the British issue. The absorptive power (solar) of our GI material is about 2.00 as compared with 1.02 for the British cloth, using a white standard which is 1.00. Recommend that considerations be given to the selection of light weight uniform using British type as criteria" (ETMD, Rear Echelon Hq CBI, 12 August 1943)

These comments and recommendations were referred by SGO to the Quartermaster General's office for consideration.

As a malaria prevention measure, standard operating procedure throughout the Theater was to go into mosquito resistant clothing at sundown, and to apply repellent to exposed skin. Such clothing consisted of high shoes, long trousers or slacks, and long sleeved shirts. Both male and female personnel were required to wear the same uniform at night.

There was some dissatisfaction about placing female personnel in trousers and shirts. Although the vocal objections came from the women, the complaint had its basis on the reaction such clothing had on the men. Few women have a figure which can be improved by the added bulk of a shirt tail tucked inside of trousers, especially if these are cut to fit a masculine form. The revolt took diverse directions until brought under control by the Director of Nurses in the Theater Surgeon's Office who assisted in the adoption of tailored shirts, and slacks for wear as appropriate. Further consideration might be given to styles of women's clothes in areas where protection from mosquitoes is such an important factor in malaria control as it was in this Theater. Indian working women wear full floor-sweeping skirts, bodice-like brassieres and a loose wrap.

A survey of various types of dress worn in tropical countries may assist in evolving as sensible a solution for women as it is felt has been reached in the "bush jacket" and, for daylight wear, shorts and socks for men.

MILITARY "BUSH JACKET" FOR SUMMER WEAR IN INDIA



Front View



Rear View

IV - NUTRITION

The establishment of a Theater of Operations by the U. S. Army in India and Burma presented subsistence problems not encountered in other parts of the world. Our forces were not invading a hostile country where subsistence could be requisitioned from the populace and where supply lines could be appropriated and set up without regard for the native population. They came as "guests" to a densely populated, allied country of dubious friendliness in the throes of political unrest. Furthermore, a large proportion of the population was on the brink of a great famine which was to destroy by starvation a million and a half people in 1943. The U. S. troops could not be concentrated within a few well-consolidated areas, but because of military necessity were scattered in small groups separated by thousands of miles. The existing lines of communication between these areas were extremely primitive or non-existent. Instead of finding established agencies, either civil or military, capable of supplying adequate subsistence to our relatively small forces, it was found that the civilian population was starving and that the British or Indian Armies were incapable of supplying a ration which was acceptable to our troops. It was intended, however, for these troops to "live off the land."

When the first contingent of troops arrived in India from the United States early in 1942, no provision had been made for the continuous supplying of these troops with subsistence from the Zone of the Interior. A reserve stock of B rations was sent to this Theater, but these were not to be used except in emergencies. It was intended to subsist these troops on supplies obtained from local markets and on rations obtained through the British Army. In October 1942, a Theater policy was adopted governing the subsistence of U. S. troops in India and Burma.¹ The ration consisted of the British Troops Field Service Ration obtained through the Royal Indian Army Service Corps, supplemented by local purchase of fresh supplies and by the issue of excess stocks of the reserve B ration. These reserves were augmented from time to time by shipments from the Zone of the Interior which permitted rotation of stocks to prevent spoilage and which provided a reserve for subsequent incoming troops.

Unfortunately the excess stocks of B ration reserve were slow to accumulate and confusion existed as to what constituted an emergency. It was often difficult to maintain the reserve at the authorized level because of the rapid expansion of the Theater. The British Troops Field Service Ration was found to be unsuitable for U.S. troops because many items such as port and soya links, corned beef and mutton, were not acceptable and hence were not eaten. The milk allowance received from the British Army amounted to only two ounces of tinned milk per man per day, which is not considered to be adequate for U.S. troops. Practically no fresh milk was available because of the insanitary conditions under which it was produced. Fresh meat was scarce and of inferior quality, because of the Government of India law which prohibits the slaughter of bullocks in good state of health under ten years of age, pregnant cows, or cows in milk.² Other fresh meats were not available. Difficulty was also encountered in obtaining sufficient quantities of high quality fresh fruits and vegetables. These were available to troops in the metropolitan areas such as Karachi, New Delhi, and Calcutta, but were scarce in isolated regions such as the Brahmaputra river valley. Menus were prepared in the various Section Headquarters located in the above mentioned cities but these could only be used in the immediate vicinity because of difficulty of distribution.

Numerous complaints were received by the Surgeon that the dietary of the troops was deficient in calcium, thiamin, riboflavin, and Vitamin C. Medical officers reported a reduction in the efficiency of the command which they attributed to malnutrition. A large proportion of the troops reporting for sick call complained of weakness, insomnia, lassitude and gastric complaints which are suggestive of a deficiency state. An increase in the occurrence of gingivitis was also observed which may have been precipitated by a vitamin C deficiency.³

The situation became serious enough to warrant careful study of the adequacy of the ration and means of improving the nutritional status of the troops. In mid-year of 1942 a Nutrition Officer, Captain M.J. Babcock, was assigned to this Theater as Nutrition Consultant to the Surgeon, Headquarters, Services of Supply, China Burma India. He made a thorough study of the dietary of the troops and concurred in the opinion that the ration was deficient in calcium, thiamin, and riboflavin. Dietary studies of the troop ration continued throughout the autumn and winter and were summarized in a report in January, 1943.⁴ On the basis of these studies, the Surgeon recommended that:

1. The allowance of canned milk obtained from the U.S. be increased to supplement the two ounces received from the British Army;

2. Troops in Base Section No. 3 (Ledo area) be issued the B ration instead of the British Troops Field Service Ration; and

3. The ration of other troops stationed in Assam be supplemented with canned fruits and vegetables.

Troops in the forward areas deserved preference in subsistence because they were fighting and doing heavy work under very adverse conditions and because local supplies were not available. These recommendations were put into effect. Stocks of B rations which were beginning to accumulate in excess of the authorized reserve were diverted to the use of hospitals and combat air crews. The Surgeon also recommended that the Expeditionary Ration No. 1 (Tropical and Temperate Climate) be adopted as the field ration for this Theater. No action was taken on this recommendation at that time and the policy of "living off the land" was continued except in the Ledo area.

As a result of the complaints described above that the ration was nutritionally inadequate, many requests for the issue of multivitamin tablets to supplement the ration were received by the Surgeon's Office. Since this item was in critical supply at that time, it was necessary to establish a Theater policy governing the issue of multi-vitamin tablets to supplement the ration in order to ensure expeditious use of available supplies. The policy⁵ adopted early in 1943 was that previously formulated by the Surgeon General.⁶ It authorized the issue of multivitamin tablets to supplement the ration of troops only upon certification by the unit medical officer that a specific deficiency existed and that no foods were available to correct this deficiency. Requisitions accompanied by the certificate were required to be submitted to the Surgeon, Headquarters, Services of Supply, China Burma India, for final approval. Later in 1943 this policy was liberalized to include the issue of multivitamin tablets to combat air crews and units subsisting on emergency rations.⁷

At this time an interesting outbreak of nutritional deficiency disease occurred in this Theater in the form of beri-beri among Chinese troops at the Chinese Training Center at Ramgarh, India.⁸ This outbreak was investigated by the Nutritional Consultant. Between 8 August and 25 September 1943, there were hospitalized 199 patients with beri-beri as the primary cause of hospitalization. Many cases were not admitted but were treated

as out-patients at dispensaries. Other symptoms of deficiency diseases such as night blindness, cheilosis, glossitis, and osteomalacia were also observed. These troops had recently arrived from China and most of them had a background of chronic malnutrition. The rice eaten by some of them had spoiled and required much washing which caused the extraction and loss of nutrients. The diet prescribed for Chinese enlisted men in India at that time had the following composition:

Rice, polished	2 lbs
Meat	8 ozs
Veg., fresh (1/3 green)	8 ozs
Oil, cooking	5 gal/1000 men
Salt	½ oz.
Tea	1/3 oz
Firewood	3 lbs

A nutritional analysis of this ration made at that time showed the following daily allowances of nutrients:

<u>Nutrient</u>	<u>Chinese Troop Ration</u>	<u>Recommended</u>
Calories	3950	4000
Calcium, mg	170	800
Iron, mg	16.2	12
Vitamin A. I.U.	2570	5000
Thiamin, mg	.57	1.8
Riboflavin, mg	1.46	2.40
Niacin, mg	22.5	20.0
Ascorbic Acid, mg	38.6	75.0

This dietary was obviously deficient in calcium, vitamin A, thiamin, riboflavin and ascorbic acid. The ration was changed as follows: One and one-half pounds of undermilled rice was substituted for the two pounds of polished rice; one-half instead of one-third of the vegetables allowance was prescribed as green; the following ingredients were added; 2 ounces of dried beans, 2 ounces of peanuts, and 4 ounces of atta (whole wheat flour). Subsequent to these changes, no further wide-spread incidence of nutritional disease occurred among troops of the Chinese Army in India or Burma.

With large numbers of troops moving into Assam during the latter part of 1943 and in early 1944, the problem of supplying subsistence from the port of Calcutta became acute. The Bengal-Assam Railway system was sorely overtaxed and since the trip

from Calcutta to Assam took twelve days, only non-perishable items were so shipped. Barges carrying supplies up the rivers of East Bengal were often stranded for days because of the great variations in the flow of water. There were no roads connecting Calcutta with Assam, so motor transport could not be used. Because of the uncertainty of supply, it was impracticable to prepare a menu in advance for the forward areas. The local markets were quickly depleted of foods, and the reserve of B rations was seriously unbalanced. It was necessary, therefore, to employ air lift to transport much of the subsistence from Calcutta to Assam.

As the combat troops and those engaged in the construction of the Ledo Road, petroleum pipeline, and signal communications moved forward from Ledo into Burma, many of the units had to be supplied by air dropping. The Surgeon advised the Quartermaster in the formulation of an air-dropped ration composed of B ration components which was accomplished by the full use of dehydrated products. C and K rations were also used for this purpose. Air-dropped rations were always supplemented with multivitamin tablets.

Supply to the forward areas was always uncertain under optimum conditions, but it became precarious during the spring-summer season of 1944. It became necessary, therefore, to liberalize the Theater policy on the issue of multivitamin tablets to supplement the ration. This was done by authorizing the issue of one tablet per man per day to all troops stationed in Assam and Burma until such time as transportation would allow the supplying of adequate subsistence to all units.⁹

Early in 1944 the Theater was visited by Colonel Paul E. Howe, then Chief of the Nutrition Division, Office of the Surgeon General, who studied the ration problems of this Theater. In his report Colonel Howe attributed the inadequacy of the ration to the attempt to "live off the land", to dependence on British supplies which were often not available or acceptable, and to inadequacy or failure of transportation. He recommended that the Theater adopt the Expeditionary Force Menu No. 1 (revised 1 October 1943)¹¹ as the basic field ration. He also recommended that additional Nutrition Officers be assigned to the Theater to work with the troops in the field.

In March 1944, a number of Nutrition Officers were assigned to this Theater. The following were their assignments:

Captain J.P. Manson, Hq. ICD-ATC, Calcutta, who covered Air Transport Command installations in India and China.

Captain G.C. Ring, Hq Adv Sec. Ledo, Assam, who covered Services of Supply installations around Ledo and the Ledo road as far as Myitkyina;

Captain C.J. Koehn, Hq Base Sec, Calcutta, who covered the eastern half of India;

Captain Milton Lindeman, Hq Northern Air Service Area Command, which supplied Air Force installations in Northern Burma.

Later arrivals were Captain E.L. Powell who replaced Captain Koehn at Calcutta, and Captain P.E. Johnson who replaced Captain Ring at Ledo. The duties of these Nutrition Officers were to conduct nutritional surveys in troop messes in the field to determine the nutritional adequacy of the dietary consumed by the troops, to advise the Surgeon in matters pertaining to nutrition, and to assist the Quartermaster in preparing menus and in selecting nutritionally equivalent substitutes for unavailable items.

In July 1944, the Expeditionary Force Menu No. 1 (revised 1 October, 1943) was adopted as the basic field ration for this Theater in accordance with Colonel Howe's recommendation. Such components as were available from the British were procured in bulk from the Royal Indian Army Service Corps under reverse lease/lend agreement.¹² These items included flour, salt, sugar, condiments, fresh eggs, meats, fruits, and vegetables. Components not available locally were imported from the Zone of the Interior and a 90-day reserve stock level maintained. The indigenous products were of low quality compared with U.S. Army standards. The flour was particularly subject to criticism by our troops. It was not enriched and therefore was low in vitamin content, was heavily infested with weevils and, because of its low gluten content, it was unsuitable for bread making. The fruits were of fair quality, but many species were previously unknown to the troops and were not well received. Such fruits were mangoes, papayas, and leechie nuts. The vegetables were generally of poor quality, picked after the optimum stage of maturity and were usually wilted or spoiled upon arrival at their destination. As in the case of fruits, many of the vegetables were unknown to the cooks who were at a loss to know whether a new botanical specimen issued to the mess should be boiled, fried, or baked; or whether it should be seasoned with salt or sweetened with sugar. The resulting product was usually highly unpalatable.

The troops in this Theater subsisted for several months on the ration as prescribed by the Expeditionary Force Menu No. 1 (revised 1 October 1943), supplemented with such indigenous fresh produce as could be obtained from the Royal Indian Army Service Corps. During that time complaints about the quality and quantity of the ration became more and more numerous. The following were the most commonly expressed complaints:

The caloric value of the ration was inadequate;

The canned meat components became monotonous, were unacceptable, and were not eaten by the troops;

The dried eggs and whole milk powder were rancid and therefore were not consumed;

Insufficient bread and spreads were issued;

Cereal products were heavily infested with weevils.

The complaint that the caloric value of the ration was inadequate as prescribed by the EFM No. 1 was justified in many instances. The food prescribed by this ration contained 3945 calories whereas nutritional surveys conducted in hard working units such as port battalions and truck companies revealed that food actually consumed exceeded 4000 calories if it were available. The port battalions and aviation engineer battalions, which worked three eight-hour shifts daily, often served as many as six meals a day. This was very difficult to accomplish with the food prescribed by the EFM No. 1. The canned meat components of the B ration are highly spiced and quickly become monotonous and therefore unacceptable. Much of the meat was not consumed, and therefore the ration as consumed was lowered in nutritional value.

The dried eggs and powdered whole milk components of the B ration are too perishable to be sent to a tropical Theater so far from the source of supply. It required from 60 to 90 days travel time to ship subsistence from the Zone of the Interior to India and for most of that time the temperature was around 100 degrees Fahrenheit. An additional 30 days was required to unload and transport the supplies to the various sub-depots where they were stored for an additional 90 days at a temperature of 100 degrees Fahrenheit or higher. This latter storage was necessary for the proper rotation of the 90-day reserve stocks. Thus it was necessary to subject these products to high temperatures for a minimum of 6 months before they could be used. Actually they were from one to two years old before they were issued. The powdered eggs were discolored and had a disagreeable taste which was difficult to disguise;

consequently the mess personnel seldom bothered to prepare them as a breakfast dish and when they did, most of them were discarded. The powdered eggs, however, were extensively used in baking and cooking. The whole milk powder could not be made into a palatable beverage unless it was mixed with chocolate or some other flavoring to mask its disagreeable taste. It could be used satisfactorily, however, in cooking and baking.

Because of the long storage at high temperature, the dehydrated vegetables had deteriorated considerably. Many of the cooks in the Theater had not had previous experience in the preparation of dehydrated vegetables and, therefore, were not adept in preparing appetizing dishes from them. Consequently the dehydrated vegetables were not acceptable and considerable waste resulted. This had a deleterious effect on the nutritional adequacy of the ration. The Surgeon recommended that a Food Service Program be established in this Theater to correct these difficulties, but this recommendation was not favorably considered at that time.

The hospitals found it difficult to operate on the field ration and hospital supplement ration as prescribed by the Issue Chart to EFM No. 1 (revised 1 October 1943). The hospital ration did not furnish adequate subsistence for patients under the climatic and epidemiological conditions of this Theater. The high proportion of patients admitted with febrile and diarrheal diseases resulted in the use of a large percentage of special or restricted diets. The subsistence issued was particularly deficient in fruit juices and the more acceptable canned meat items. An attempt to correct this was made in Base Section No. 2 (Eastern half of India) by issuing one field ration for each patient and allowing the hospital a monetary credit with the Quartermaster equal to one-half the cost of the field ration for each patient in lieu of the automatic issue of the hospital supplemental ration. This did not work out satisfactorily because the purchase of certain items of the hospital supplemental ration in excessive quantities by some hospitals quickly depleted stocks of these items, which were being sent to this Theater on the basis of troop strength as prescribed by the Issue Chart to EFM No. 1. Thus, many hospitals were not able to obtain the subsistence items required for the formulation of the special or restricted diets.

In September, 1944, the Surgeon requested that the ration scale for troops in this Theater be revised, that a more liberal hospital supplemental ration be provided, and that a uniform ration system be adopted for all hospitals. The Nutrition Consultant assisted by the Nutrition Officers of the Base Sections and Hospital Dietitians, in cooperation with the Quartermaster, drew up a new ration scale in the form of the Basic Subsistence Issue Chart

For India and Burma and also set up a uniform ration system for hospitals. This was accomplished in October, 1944, and the new policy submitted to the Theater Commander for approval in November. It was put into effect 1 January 1945.¹³

The Basic Subsistence Issue Chart prescribed a ration providing a maximum of 4,500 calories. The revised ration provided a greater variety of meats including canned ham (to increase the thiamin content of the ration), canned pork and gravy, frozen boneless beef and lamb carcass. The frozen and fresh meats provided more of the B vitamins than the canned beef components of the EFM No. 1. An increase in juices, fruits, bread and spreads were also provided.

All hospitals in the Theater were authorized to draw one field ration for each patient plus an automatic issue of the revised hospital supplemental ration prescribed by the Basic Subsistence Issue Chart for India and Burma. This revised hospital supplemental ration prescribed more liberal allowances of canned meats, milk, fruit juices and canned vegetables than the EFM No. 1. The quantities of the less useful items such as dehydrated soups and vegetables purees were reduced.

Early in November 1944, Captain Babcock was returned to the Zone of the Interior under the Theater rotation policy and he was replaced by Captain C.J. Koehn as Nutrition Consultant to the Surgeon.

With the adoption of the Revised Subsistence Issue Chart it became necessary to publish a monthly master menu for the Theater. The preparation of this menu was undertaken jointly by the Theater Quartermaster and the Theater Surgeon. This menu was used as the basis of issue of subsistence to all unit messes in India and Burma. This was necessary to insure equitable distribution of all ration items, particularly the fresh and frozen meat components. The menu was also used to exercise control over the stock levels of subsistence items. For example, if it appeared that the supply of a certain item was diminishing at such a rate that it would be exhausted before the supply could be replenished from the Zone of the Interior, the quantities prescribed by the menu would be reduced so that the supply would last until replenished. Conversely, if stocks of an item greatly exceeded the reserve level, an increased issue would be prescribed. If stocks of certain items began to accumulate in the messes, the rate of issue would be reduced in the menu. The master menu was subjected to nutritional analysis each month before publication to insure that the optimum quantities of nutrients were prescribed with the available foods.

The increase in the ration, particularly for hospital patients was very well received in the field. Some difficulties were encountered, however, in making adjustments to the new ration scale.¹⁴ Subsistence supplies due in to replenish stocks depleted by the increased issues failed to arrive when expected. Shipments of canned ham were cancelled. This deficiency of supply was apparently related to increased demands by other more active theaters. Fortunately the shortage of subsistence was confined to staple and non-perishable items. The supply of frozen boneless and imported carcass beef was uninterrupted. This issue of fresh meat boosted the morale of the troops more than any other factor connected with food. It served to break the monotony of an otherwise tiresome ration.

The frozen boneless beef, obtained from the Zone of the Interior via reefer ships, was conveniently packed in fifty-pound boxes and was separated into three cuts; roasts and steaks, stewing and boiling meat, and ground meat. These were unloaded from the ships at Calcutta to a nearby cold storage warehouse where they were kept frozen while awaiting transhipment. They were then loaded into cargo planes and flown to the general depots and sub-depots in the forward areas. Here the meat was kept frozen in cold storage plants until picked up by unit ration trucks. This system worked remarkably well and very little meat was lost through spoilage. All of the meat received from the Zone of the Interior was shipped to the forward areas. The frozen boned and carcass meat obtained through the British Army was distributed in the rear areas.

Some difficulty was encountered in the feeding of Chinese patients in American hospitals in the forward areas. The basic ration for Chinese enlisted patients was the revised Chinese troop ration described earlier in this discussion. The components of this ration were obtained through the Royal Indian Army Service Corps and were prepared by the Chinese themselves. Cooking was done in large drums or tubs over an open fire where they prepared their rice, stews and soups. An attempt was made to exercise supervision over the cooking and serving of the food by U. S. personnel, but it was almost impossible to change centuries' old customs. For example, when fresh meat was issued, it was necessary to cut it up and issue it to each patient. The patient then cooked it himself according to his particular custom or entrusted its cooking to some friend. Because of their customs of cooking their foods in large volumes of water, many of the water soluble nutrients were lost. In order to prevent the occurrence of deficiencies, Marmite, a brewers' yeast preparation, was added to the soups. To supplement the ration further, all of the hospital comfort items of the British Troops Field Service Ration were made available to hospital commanders who

decided which items were necessary for the welfare of the patients. These items consisted of canned milk, meats, fruits, sugar, etc. Upon the insistence of the Chinese, these items were issued individually to each patient by an American NCO in order to insure equitable distribution. It was over the issue of these comfort items that trouble arose. It was natural that hospital commanders had different ideas as to just which comfort items were necessary and in what quantities. A Chinese patient would find out that a neighboring hospital was issuing an item he was not receiving; he would then complain that he was not getting what he was entitled to. This became widespread among the patients of all hospitals in this area and no hospital escaped criticism on one score or another. The Chinese found these tactics very useful in playing one hospital against another to secure more comfort items than were necessary. A patient would insist on going to one particular hospital and would boycott the others. Since all of the patients were well fed, this situation was absurd, but rapidly became intolerable. A meeting was called by the Surgeon, Advance Section, which was attended by the Nutrition Officer and the hospital commanders concerned. A uniform scale of hospital comforts was evolved which was put into effect in all hospitals caring for Chinese patients.¹⁵ After the Chinese were made to understand that the food was the same in all hospitals, the trouble subsided.

Nutritional surveys conducted in Advance Section earlier in 1945 showed that in spite of the more liberal ration prescribed by the Basic Subsistence Issue Chart, the ration was still deficient in thiamin, the average daily intake being 1.00 mg. per man. The riboflavin intake was also low. The ration as prescribed was low in these vitamins because of two factors: the lack of fresh pork, and the use of unenriched, indigenous flour which comprised forty per cent of the issue. Although few cases of clinical avitaminoses were ever seen in United States troops in this Theater, an increasing number of cases were seen in the forward areas who complained of vague symptoms suggestive of subclinical thiamin deficiency, i.e. anorexia, nervousness, indigestion, fatigue, etc. Some of these cases responded to therapy with thiamin hydrochloride although it was not proved that other factors coincident to hospitalization were not the cause of improvement. The use of thiamin preparations by hospitals in the forward areas increased considerably in 1945 indicating that the long continued low intake of thiamin was beginning to show effects.

Since lean pork products contain approximately five times as much thiamin as lean beef, the Surgeon recommended that pork loins and hams be requisitioned in lieu of half of the beef being procured monthly from the ZI. He further recommended that the use of unenriched flour be discontinued and that 100 per cent enriched

flour be procured from the ZI. The former recommendation was acted upon the first shipment of boneless pork loins and hams arrived in the Theater in July 1945. This pork not only substantially increased the thiamin content of the ration but relieved the monotony of the previously predominantly beef dietary. The second recommendation was not favorably considered at that time because of the Theater policy to procure as many items locally as possible to conserve shipping space.

In April 1945 the War Department directed¹⁶ that the ration scale for this Theater be reduced so that the total quantities of foods within the various food groups (with several exceptions) conformed with the quantities prescribed by the Issue Chart to EFM. #1. (revised 1 October 1943). The Basic Subsistence Issue Chart for India and Burma was revised, therefore, effective 1 June 1945.¹⁷ The revised ration provided approximately 4,150 calories, 2.06 mg. thiamin, and 2.78 mg. of riboflavin daily. The increase in thiamin content of the ration in spite of the decrease in calories resulted from the inclusion of 0.13 pounds per man per day of lean pork products. It was necessary to reduce the total weight of issue of leafy, green and yellow vegetables, but this was compensated for by reducing the weight of the canned vegetables and increasing the dehydrated. Since fresh vegetables were usually substituted for the dehydrated, the net result was an increase in this group. The reduction in calories was caused by the decrease in the issue of fats and potatoes. Adjustments were made between the various food groups so that the overall decrease in the ration could be accomplished without seriously affecting its nutritional value.

The limitations placed upon the ration by the War Department also applied to the hospital supplemental ration. It was necessary, therefore, to place the hospitals back on the ration prescribed by the Issue Chart to EFM. #1 (revised 1 October 1943). Within one month reserve stocks of supplemental items on hand in the hospitals were exhausted and the subsistence issued was insufficient to allow for the proper dietary management of patients.¹⁸ The Nutrition Consultant and the Quartermaster Subsistence Officer studied the situation very carefully in order to determine how the hospitals could be furnished adequate subsistence without exceeding the overall allotment of subsistence to this Theater. They arrived at the following conclusions: Hospital supplemental ration items were allocated to this Theater on the basis of troop strength, assuming fifteen per cent hospitalization of the command. Under the existing Theater policy the hospital ration items received with 10,000 rations were, therefore, issued to 1,500 patients. Statistics revealed, however, that in this Theater only five per cent of the command was hospitalized. Thus, two-thirds of the items earmarked

for hospitals remained in the depots unused. The problem could be solved, therefore, by pro-rating the essential hospital items received with 10,000 rations among 500 patients without exceeding the quantities of food allotted this Theater. The hospital supplemental ration was revised, therefore, to increase the allowances of fruit juices, canned meat and other essential items effective 1 August 1945.¹⁹ Since that time, hospitals have been able to maintain a high standard of dietary management.

During the summer monsoon of 1945, nutritional surveys conducted in the forward areas indicated that the consumption of thiamin and riboflavin was not optimum. This was attributable to lack of fresh foods in the ration and to the impossibility at times of transporting fresh or frozen meats to the forward units along the road. Transportation failure resulted from temporary wash-outs of the Stilwell Road caused by torrential rains and from low visibility which grounded aircraft. The Surgeon, therefore, requested that the Theater Commander obtain authority from the War Department either to procure vitamin preparations containing thiamin, riboflavin, and niacin for the enrichment of the indigenous flour or to procure 100 per cent enriched flour from the ZI. The authority for the procurement of bulk vitamins or 100 per cent enriched flour was granted.

The enriching of the indigenous flour appeared to be the most practicable means of increasing the vitamin content of the ration. Before requisitions were placed for the vitamins, GHQ (India) was requested to allow the U.S. Army to provide bulk vitamins to the Indian mills furnishing us flour for the purpose of enriching this flour. This request was not favorably considered by GHQ (I), since the flour for U.S. troops and for the British and Indian troops all came from a common stock pile and they considered it impracticable to enrich the flour for the U.S. troops without enriching all of the flour. The project, therefore, had to be dropped. Before the question of procuring 100 per cent enriched flour from the ZI could be considered, the end of the war with Japan had occurred. Since early evacuation of the Theater was contemplated, reserve stocks of enriched flour were released for issue which were sufficient to provide 100 per cent flour for the troops until evacuation of the Theater had been accomplished.

The difficulty in maintaining an adequate dietary arising from the use of unenriched flour is just one example of the problems encountered in an attempt to subsist troops in a foreign country on indigenous foods. This applies not only to flour but to such foods as fresh vegetables, which are raised from undeveloped strains on infertile land, and meat from malnourished animals.

A comprehensive nutritional survey of India and Burma prior to the entry of the troops into these areas would have allowed our forces to anticipate the difficulties later encountered and steps could have been taken to prevent them. The obvious course that would have been followed is the continuous supplying of these forces from the beginning with the balanced Expeditionary Force Ration. In case such items of this ration as flour were required to be obtained locally arrangements could have been made to correct the resulting deficiencies. The most practical means of accomplishing this is by furnishing tablets containing thiamin, riboflavin, and niacin for use in enriching bread. The proper quantities and proportion of each vitamin could be incorporated into a tablet to be used for each unit of flour used in making bread. This can be dissolved in the water so that uniform distribution throughout the bread can be accomplished.

Experience in this Theater has shown that it is impracticable to send such dehydrated products as powdered eggs, whole milk powder, and dehydrated vegetables to a tropical climate unless a quick turnover can be arranged or facilities provided to store these items under relatively cool conditions. Surveys conducted in this Theater showed that over 50 per cent of all dehydrated vegetables prepared in the messes were discarded which represents a waste of effort in their manufacture and waste of the original product which could have been used to feed the civilian population. If at all possible only canned foods should be sent to Theaters in tropical climate.

Although it may be economical to subsist relatively small forces on the rations of allied troops, this procedure was found to be highly unsatisfactory in this Theater. There is a great difference in food habits between various countries even between such closely allied countries as the U.S.A. and England. The US troops almost unanimously condemned the British rations. This is attributable to their dislike of such items as mutton, corned beef and pork and soya links and to the inferior quality of many foods. Since the U.S. standards and specifications for foodstuffs are the highest in the world, it appears unwise to attempt to subsist our troops on the inferior rations of other countries.

Another cause of dissatisfaction with the ration among the U. S. troops in this Theater was the lack of skill on the part of the cooks in preparing the B ration components. Many of the men serving as cooks had no training in cooking and many of those who had, had left the ZI without learning how to prepare such foods as dehydrated eggs, vegetables and the various stew and hash components of the ration. The Surgeon repeatedly recommended that a

Food Service Program be established in this Theater to correct this deficiency. This recommendation was not favorably considered by the Theater General Staff, which is unfortunate because such a program would have allowed the training of competent mess personnel in the Theater and would have provided competent supervision over the preparation of food for the enlisted men. It is strongly recommended that in future operations, a Food Service Program be made an integral part of the organization of every Theater of Operations.

In summary it may be said that the history of nutrition in the India-Burma Theater is one of constant struggle against odds to improve the nutritional adequacy of the ration. The difficulties encountered were the inability of India and Burma to supply appreciable quantities of acceptable subsistence to sustain our Army, the length of the supply line from the ZI which was the longest in the world, the priority in subsistence given the more active theaters of operations, the adverse climatic conditions encountered, and the inadequate transportation facilities in the interior. In spite of these difficulties, a slow but steady improvement in the nutritional quality of the ration was obtained. Except for the outbreak of beri-beri among Chinese troops, there were no significant indications of malnutrition in this Theater.

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V - MESS SANITATION: ARMY MESSES,
COMPOUND GERMICIDAL RINSE, AND
CIVILIAN EATING ESTABLISHMENTS.

1. Army Messes.

The usual means by which organisms causing intestinal disease can become implanted in the intestinal tract is by the ingestion of contaminated food or water, or by the placing of contaminated objects in the mouth. The frequency and degree of contamination which an army experiences is dependent on the number of contaminating organisms in its environment and the extent to which adequate safeguards are taken to prevent contamination of food and drink.

The environment of U.S. troops in India was well seeded with the organisms causing intestinal disease. Dysentary and diarrhea are wide spread among the civilian population, causing an annual average of 261,924 reported deaths in British India between 1932 and 1941, a death rate of 4.2 per 1000 per annum. The number of cases treated in hospitals and dispensaries varied from one million to one and a half million annually¹. There is no doubt but that the actual number of deaths from this cause was much higher and that only a small part of all diarrheas were treated.

The British army had experienced a high disease rate for dysentary, reported at 25.5 per 1000 per year in 1937 and 33.0 per 1000 per year in 1940. These rates were for diagnosed dysentery alone, however, and did not include diarrhea and other intestinal disease. Laboratory findings indicated the number of cases of amoebic dysentery to be only about one-twentieth that of bacillary dysentery.¹

The wide prevalence of intestinal disease in India is due to several causes. The climate is warm and wet throughout much of the year and enables disease organisms to live longer outside the body. The common method of depositing human waste in the open on the surface of the ground promotes fly breeding and permits pollution of all surface water. The unhygienic habits of the people and their ignorance of the common routes of disease transmission "from feces to food through flies and filth" results in wide spread contamination of prepared foods and drinks.

Because of the conditions under which the U. S. Army in India was required to operate, it was impossible to isolate Army personnel from civilian contact. Part of the food supply had to be obtained from local sources. A shortage of personnel for

activities directly connected with military operations resulted in the employment of natives for preparation of food and other menial services as well as for almost all non-skilled labor.

During 1942 there were reported 700 admissions of U.S. Army personnel to hospitals for intestinal disease, a rate of 123 per 1000 per annum. Increased troop activity, including expansion which usually exceeded the facilities available, resulted in increased rates for the diarrheal diseases. In 1943 there were 6,706 admissions, a rate of 148, and in 1944 there were 28,853 hospital admissions for diarrhea and dysentery, with a rate of 185 per 1000 per annum. It is difficult to estimate the actual number of cases of diarrhea because many did not report on sick call or if they did were treated on a duty status. On the basis of hospital admissions alone, the disease rates for diarrhea and dysentery were roughly equal to those for respiratory disease (cold and influenza) which were 150, 159, and 176 respectively, during 1942, 1943 and 1944 and to those for malaria which were 165, 181, and 174 for the same three years.²

Although the solution of the diarrheal disease problem was theoretically simple, it was extremely difficult to put into practise. Fecal contamination was everywhere. Drinking water was boiled to insure destruction of amoebic cysts but handling subsequent to boiling resulted frequently in further contamination. Chlorination after boiling may have reduced the danger from fresh contaminations of dysentery bacilli but probably had little effect on fresh contaminations of amoebic cysts. Fecal contamination of food was insured by the retention of natives in the kitchens and mess halls. Although practically all units examined their permanent food handlers regularly and some examined all mess employees, this did not remove the danger of intestinal infections developing in natives between examinations, nor the danger of non-infected natives carrying pathogenic intestinal organisms into the kitchens on their feet, hands, or clothes.

All units were cautioned as to the ever present danger in having native personnel about the kitchens and mess halls, but only a few tried to get along with American mess personnel alone. Most messes compromised by permitting natives to do all the cleaning tasks and often to prepare foods for cooking. The serving of prepared foods and the handling of eating utensils was usually reserved to American personnel. Even in this important matter there was much latitude and the usual officers' mess permitted both food handling and serving by native personnel.

In most cases it was difficult to determine the source of intestinal disease when it occurred among military personnel. These being messed in non-combat areas usually were provided a fairly safe water supply, but they often had access to civilian eating places. Sanitation in these establishments was always unsatisfactory, but they were permitted to be "in-bounds" as long as they appeared reasonably clean and made a conscientious effort to remain so. In areas of active combat individual packaged rations were issued and their use reduced infection. However, intestinal infections from water were much more likely under combat conditions where troops had to depend on the treatment of raw water in either canteens or lyster bags and became careless in all matters not directly related to protection from enemy fire. Thus it was difficult to determine the relative importance of army mess sanitation, civilian restaurant sanitation, and water purification as causes for the high incidence of intestinal disease.

The sanitation of army messes had been a subject of concern throughout the history of the U. S. Army. Army Regulation 40-205 outlines the conditions to be maintained for the preservation of health. The high incidence of intestinal disease in the army as a whole occasioned the publication of paragraph V. WD Circular 277, 1942, which was republished in this Theater³ because of its special applicability. Efforts were made through instructions and directives to reduce as much as possible the dangers of contamination through foods. Personnel were advised to avoid eating lettuce, tomatoes, radishes, onions and other vegetables unless thoroughly cooked, while only thick skinned fruit was permitted after washing and careful removal of the peel.⁴ Information on cholera, bacillary and amoebic dysentery, and the typhoid fevers was supplied to all medical officers in the theater at an early date.⁵ The uniformly high bacterial counts of all fresh milk samples and the frequency of gas formers resulted in recommendations to boil all fresh milk immediately before serving.⁶ Additional reminders were given to those responsible for mess sanitation through an informal bulletin of the Surgeon's Office,^{7, 8} and through a Theater letter.⁹

Sanitary conditions in army messes continued unsatisfactory in spite of the efforts that were made to improve them. There was shortage of both supplies and personnel.^{10, 11, 12, 13} This resulted in inadequate improvisations or an attempt to get along without essential supplies, and in the widespread utilization of native labor. The importance of these factors in the high intestinal disease rates of the Theater was emphasized by inter office communications¹⁴ and in the report of the Kelser Mission,

9th November 1944.¹⁵ Through continuous efforts the levels of sanitation were slowly raised, but diarrhea and dysentery, presumably due in large part to contamination of food, continued as one of the major causes of illness throughout the existence of the Theater.

Mess sanitation in China sector of the Theater was a difficult problem, due to the special circumstances of U.S. military operations in China. It was necessary to limit all air shipments over the "Hump" to essential military personnel and material, and to provide maintenance from local sources. An arrangement was made with the Chinese Government to furnish free food and lodging for all U.S. personnel. This was done through the War Area Service Command, a Chinese government agency, which organized and staffed hostels and messes wherever we had air fields or other stations. Since we were, in effect, non-paying guests, it was not very diplomatic to criticize too severely sanitary conditions of these hostels. Continuous efforts were made, however, through inspections by medical officers, supervision by assigned mess sergeants, and, later by furnishing new equipment, to raise sanitation as much as possible towards acceptable standards.^{16, 17, 18}.

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4. Memorandum, Hq 10th Air Forces in India & China, 25 July 1942; Memorandum, Hq 10th Air Forces in India & China, Office of the Surgeon, 27 July 1942; Memorandum to G-1, Branch Office Hq, American Army Forces, CBI, Office of the Surgeon, 5 August 1942, "Health Measures".

5. Circular Letter No. 1, Branch Office Hq USF CBI, Office of the Theater Surgeon, 14 November 1942, "Notes on Treatment and Control of Certain Tropical Diseases, Adapted for India-China-Burma Theater".
6. Ltr, Hq SOS USAF CBI, 14 March 1944, "Non-potability of milk".
7. Field Medical Bulletin, Hq SOS USAF CBI Vol 2 No. 3, March 1943, "Outline for Mess Inspection", discussed the importance of careful mess inspections in the maintenance of the health of a command and pointed out the dangers of contamination by native food handlers, flies and inefficient dish washing.
8. Field Medical Bulletin Hq SOS USAF CBI, Vol 3, No. 10, October 1944, "Insanitary Mess Conditions" describes insanitary conditions found at an overseas army mess and includes a reminder of the provisions of AR 40-205 regarding mess sanitation. Field Medical Bulletin Hq SOS USF IBT Vol 3, No. 11, November 1944, "Acute communicable diseases in the IBT" emphasizes the importance of individual control measures in the prevention of intestinal and other diseases and suggests doses for the indoctrination of personnel in individual sanitary measures.
9. Ltr, Hq AAF I-B Sector, CB I, file AAF 720, 16 March 1944, "Gastro-intestinal Diseases".
10. ETMD report, Rear Echelon Hq USAF CBI, 12 August 1943, "Ice or other refrigeration facilities are not available in the field. Meat must be served within 24 hours after slaughter and all left overs discarded. For the most part, kitchen and mess buildings are only fair. Many are not screened because of the acute shortage of screening in this Theater. Permanent buildings constructed for us by the British are poorly designed with insufficient sinks and no running hot water. Messes located in the jungle must cope with heavy monsoon rains and mud, with only tents or light bamboo bashas for shelter; the climate conditions are unavoidable but the difficulties can be minimized by giving these messes priority on equipment, American rations and construction." "Both the specific and non-specific diarrhea rates would be materially lowered if messes were supervised by American personnel."
11. ETMD report, Hq India China Wing ATC, 10 November 1943; "Sanitation has been unsatisfactory, especially as concerns chlorination of water, sterilization of dishes, latrine facilities, and garbage disposal."

12. ETMD report, Hq 14th Air Force, 25 May 1944: "Mess sanitation has been generally unsatisfactory as indicated by the high non-effective rate for diarrheas and dysenteries. Flies are very numerous....(There is)... lack of equipment and difficulty in maintaining screens in adequate repair....Sanitation supplies made locally are becoming available."
13. ETMD report SOS USAF CBI, 5 July 1944: "Sanitary conditions of food handling and food supply sources are deplorable. This is felt to be the explanation of the fact that the non-effective rate for diarrheal disease is the highest non-effective rate in the Theater. Correction is impossible without considerable increase in personnel. The present inadequate supervisory personnel and employment of native food handlers therefore, if maintained, is false economy." 2nd Ind. SOS to CG 14 July 44. "Native food handlers cannot be replaced until such time as adequate military personnel is available to operate all messes throughout the Theater."
14. Check-slip, Hq SOS USAF CBI, 29 August 1944, "Notes reference Theater Memo on Sanitation of Messes in C-B-I."
15. Report from Kelser Mission, 9 November 1944, "Mess Sanitation".
16. Radio 31, TAPAS to TIGAR, 6 October 1942.
17. Letter, CE Forkner to TB Turner SGO, 19 October 1944- Extract.
18. Report from Kelser Mission, 9 November 1944, paragraph 39

2. Compound Germicidal Rinse

Information concerning the use of compound, germicidal rinse, for the disinfection of mess gear did not result in any recorded official Theater action until September 1944. Theater files contain a copy of a Circular letter from OQMG dated 28 January 1943 describing compounding germicidal rinse,¹ but the copy may be in error as to the date. It is not certain that this Quartermaster General's Circular letter was the basis for Theater action.

On 14 September 1944 a letter was sent by Headquarters, USAF in CBI to the Commanding General of all major commands in the Theater stating: "As an important measure toward the control of intestinal diseases, it is desired that compound germicidal rinse QM Supply No. 51-C-1606 will be immediately requisitioned, issued and used for the purpose of sterilizing eating and cooking utensils."² Evidently a good stock of this item had been built up at some time previously since a total of 1,665,410 units were reported on hand as of 20 August 1944.³ The basis of issue was at first 360 units per 1,000 men per 30 days, but greater amounts were desired and recommendations were made for an increase to 450 units/1000 men.^{5,6,7} These recommendations appear to have been approved since the new basis of issue (450 units/1000 men) is stated in a letter of 3 December 1944 from Hq USF, IBT to the Commanding Generals of all commands in which additional instructions are given governing the use of CGR in the disinfection of mess gear.⁸

The disinfection of fresh fruits and vegetables by dipping in boiling water was required in the Theater by letter 16 October 1944.⁹ The use of CGR for this purpose was recommended by letter of 20 December 1944 from The Surgeon General.¹⁰ Due to the heavy contamination of foodstuffs and the greater danger of infection to personnel of this Theater, these recommendations were not accepted without question. The 9th Medical Laboratory was requested to test CGR for residual chlorine, detergent action, and effectiveness as a germicide and to give its opinion on the procedure for disinfection recommended by The Surgeon General.¹¹ Additional information regarding the chemical constituents, germicidal action and the dilution-time-temperature relationships of CGR was requested by letter to The Surgeon General.¹²

After extensive laboratory tests it was reported that CGR (Mikroklene) had weak bactericidal properties, failing to completely kill representative pathogenic organisms in 30 minutes. Comparisons with hypochlorite solution showed CGR to be markedly inferior.¹³ The laboratory reports were forwarded to The Surgeon General on 3 March 1945 with a request for comments and further information. Due to the unfavorable laboratory reports, further request was made of The Surgeon General for tests of the bactericidal properties of Mikroklene.¹⁴ In the meantime a study was in progress at the 9th Medical Laboratory on the cysticidal properties of Mikroklene. A preliminary report¹⁵ of this study indicated Mikroklene was incapable of killing cysts of Endameba histolytica under test conditions.

Due to this unfavorable laboratory report and the absence of any reassuring information from The Surgeon General, it was decided to withhold the use of CGR for the disinfection of fruit and vegetables. A circular on the subject of "Preparation and sterilization of Raw Foods" was published 12 June 1945.¹⁶ It prescribed boiling for 10 to 20 seconds or soaking for 30 minutes in 200 ppm chlorine solution for disinfection of tomatoes, grapes and leafy vegetables. The boiling or chlorine treatment of thick skinned fruits that were to be peeled was not required. The Theater policy remained unchanged by the publication of WD Circular 309, 6 October 1945 and a Theater circular reiterated the requirement of either boiling or treating with 200 ppm chlorine solution fruits and vegetables that were to be eaten uncooked.¹⁷

In this theater the use of Compound Germicidal rinse for the disinfection of mess gear was supplementary to disinfection by hot water. The Surgeon's office was aware of the thermolability of the compound in the presence of heat, but felt that the detergent properties were probably of sufficient benefit to warrant continuation of its use, even though proof of its bactericidal action could not be obtained. WD Circular 309, 6 October 1945 discontinued the use of compound germicidal rinse for the sterilization of mess gear but it was our opinion that this preparation has a place in mess sanitation because of its excellent properties as a detergent and "grease cutter".

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1. Circular Letter 17, OQMG, 28 January 1943, "Compound Germicidal Rinse (Stock No. 51-C-1606)", describes packaging, use, stock control, and other QM functions for this item.
2. Letter, Hq USAF CBI to CG's all commands, 14 September 1944 "Compound Germicidal Rinse" states that "as an important measure toward the control of intestinal diseases, it is desired that compound germicidal rinse, QM supply No. 51-C-1606, will be immediately requisitioned, issued and used for the purpose of sterilizing eating and cooking utensils".
3. Check-slip, Deputy Theater Surgeon to Theater Surgeon, 16 September 1944 "Sanitary Appliances", states that 1,665,410 units CGR were on hand 20 August 1944 and a directive had been issued to all responsible agencies for its use for sterilization of eating and cooking utensils.
4. Letter, Hq SOS CBI to all SOS commanders 23 September 1944 "Compound Germicidal Rinse" directs the use of CGR throughout all commands and states the basis of issue to be 360 units/1000 men/30 days.
5. Check-slip, Surgeon to QM, 6 October 1944, "Use of Compound Germicidal Rinse" recommends increase in allowance to 450 units/1000 men/month, because of the high diarrheal rate throughout the Theater and the common use of native help in messes in kitchens.
6. Check-slip, USF Req Supply to SOS Surgeon, 14 October 1944, "Use of C.G.R." states that request for increased allowance was forwarded to LAPOE with concurrence.
7. Radio CSA 10469, 17 October 1944, LAPOE to IBT states that the request for increased allowance of CGR was approved and forwarded to OQMG.
8. Letter, Hq USF IBT to CG's all commands, 3 December 1944, "Supplies for maintenance of Sanitation", lists compound germicidal rinse, rate of issue 450 units/1000 men/month, and describes recommended methods of use. These include a statement that C.G.R. does not lose its germicidal quality at high temperatures of the water and directs its use in the final rinse when facilities are lacking to provide adequate amounts of hot water unless other measures are taken to insure 50 ppm free chlorine.

9. Letter, Hq USF CBI to CG's all commands, 16 October 1944 "Sterilization of fruits and vegetables", directs that all vegetables and those fruits without a thick outer skin, when served uncooked, are to be dipped in boiling water for 30 to 60 seconds prior to serving. Fruits with thick outer skin are to be washed and then peeled prior to eating.
10. Letter, The Surgeon General to Surgeon IBT, "ETMD" 20 December 1944, paragraph 4a, page 11, Intestinal Disease, advises use of CGR for disinfection of fresh fruits and vegetables that are to be eaten uncooked.
11. Letter, Hq SOS IBT to CO 9th Medical Service Detachment (Lab) 2 January 1945, "Compound Germicidal Rinse", requested a laboratory study of CGR to determine its chlorine content, germicidal action and detergent action.
12. Letter, Hq SOS IBT to SGO, "Compound Germicidal Rinse (Mikroklene)", requests information concerning chemical constituents, germicidal action, relationship of germicidal action to dilution and temperature, available chlorine, and clarification of instructions for use of CGR.
13. Letter report, 9th Med Ser Det (Lab) 23 February 1945 "Bactericidal properties of Mikroklene", describes laboratory tests of solution of both Mikroklene and hypochlorite against Staph. aureus, E. typhosa and Corn. diphtheria with tabulated results of bactericidal action at different exposure times.
14. Letter, Surgeon, SOS IBT to SGO, 8 March 1945 "Compound Germicidal Rinse (Mikroklene)", reviews recent developments which have caused the Theater to hesitate in adopting the use of CGR for disinfecting vegetables and requests further experimental data regarding its effectiveness.
15. Report, 9th Medical Laboratory, 24 April 1945 "Cysticidal Properties of "Mikroklene", states that "the indications are that "Mikroklene", as issued, is not capable of uniformly killing cysts of E. histolytica."
16. Circular 67, Hq USF IET, 12 June 1945, "Preparation and Sterilization of Raw Foods", directs that all vegetables and fruits that are to be eaten uncooked will be washed and sterilized prior to serving by either boiling for 10 to 20 seconds or soaking in 200 ppm chlorine solution for 30 minutes.
17. Proposed Theater circular, "Sterilization of mess gear and vegetables", directs continuation of provisions of Circular 67, Hq USF IBT, regarding the sterilization of vegetables and fruit.

3. Civilian Eating Establishments.

Civilian eating establishments in India were at first patronized by necessity as the only available sources of prepared food for the original staff. There was no control over the safety of the food except the personal one of choosing items from the menus least likely to bring on an attack of "Karachi Torts", "Delhi Belly", or whatever variety of diarrhea the locality had to offer. Staff members and small headquarters detachments were quartered in hotels in the cities of Karachi, Delhi, Bombay, Calcutta, and other centers of military activity. Some of the hotels were entirely commercial; others were restricted to the military (British, American, or both) but were operated by civilians on a contract basis. Later, when special quarters were provided by the governments for quartering American headquarters staffs and casualties, messes were commonly operated by civilian caterers

Organized U.S. troops arriving in the Theater operated their own messes, but the quality of the food served in these was often unsatisfactory due to dependence on local produce and irregular shipments from the U.S. For morale reasons it was considered advisable to allow Army personnel to eat at approved civilian eating establishments in the neighborhood of military stations. The choice of the establishments which were approved was left to the discretion of local commanders.

The problem of safeguarding the health of personnel eating at civilian restaurants and hotels existed for the British as well as the American forces in India. It was evident from the start that the solution of this problem could be reached only by sharing the responsibilities and by taking cooperative action.

During the early part of the Theater's existence there was formed in Karachi an Allied Sanitary Commission¹ and, in Calcutta, an Allied Hygiene Committee.² The exact dates of forming these joint groups is not known from available records, but it was probably during 1943.³ Informal agreements supplemented later by more official action³ existed between Americans and British medical officers in Delhi since early 1943. The purpose of these allied committees was to arrive at standards of restaurant sanitation acceptable to all services and to divide the work of inspections. American Medical Officers would undertake the inspection of eating establishments in the sections of each city frequented largely by American troops while the British Medical Officers would do the same for areas frequented largely by their own troops. Due to the great number of small shops and restaurants only a select number of the larger and apparently responsible places would be inspected

periodically and placed either "In-Bounds" or "Out of Bounds" to all allied troops. These arrangements gave direction and order to the efforts of the Medical Department to safeguard our troops from diarrheas so commonly encountered. For detailed descriptions of sanitary conditions found in two representative large cities and of measures taken therein for the health protection of U.S. troops, reference is made to the histories of medical department activities for Delhi and Calcutta.

The control of sanitation in civilian restaurants outside the larger cities was handled principally by the In- or Out-of-Bounds method, in conjunction with continual warnings to troops of the ever present dangers of infection from eating any foods prepared outside army messes. Authority for obtaining civil cooperation in problems involving disease prevention existed⁴ but there are no records of this authority being utilized in restaurant sanitation.

The experiences and attainments in the cities of Karachi, Bombay, Calcutta, and Delhi through joint allied action were noted by headquarters staffs and the two services published directives from their respective headquarters in early 1945 establishing liaison between them for effecting common policies regarding civilian eating establishments.^{5, 6}.

There is no doubt that an appreciable amount of intestinal disease in U.S. armed forces was contracted in civilian restaurants. The difficulties in maintaining reasonable standards of cleanliness in such establishments were much greater even than the problem of enforcing sanitary practices in army messes with direct American supervision. Complete isolation from the heavily contaminated environment was not practical and the U.S. armed forces had to shoulder the penalty of being in India by experiencing a continuously high disease rate for diarrhea and dysentery.

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1. Letter, Port Surgeon APO 881, 7 December 1944, to Surgeon SOS IBT describes a meeting of the Allied Sanitary Commission, Karachi, attended by Medical Inspectors and Provost Marshals of British and American commands, at which the area was divided in sections assigned to individual inspectors whose actions on placing establishments within his area out-of-bounds would be respected by all other services, British and American.

2. History of Restaurant Sanitation, Calcutta Area. - Formation and growth of the Allied Hygiene Committee.
3. Memo. Surgeon SOS USAF CBI 19 October 1943, "Restaurant Inspections in Delhi".
4. Letter, Rear Echelon, USAF CBI, 3 April 1944, "Prevention of Disease Hazards arising from Civil Population in India"
5. Letter GHQ (India) Medical Directorate, to Deputy Director of Medical Services, Commands and Armies, "Hygiene", 14 February 1945, directs the establishment of close liaison between all services and with USA Forces to effect a common policy on sanitary control of hotels, restaurants, cafes, etc.
6. Letter, Hq USF IBT to CG's all major commands, "Civilian Eating Establishments" 15 Mar 1945 advised coordination of American British military inspection and police in cities or adjacent towns so as to present a unified front in the sanitary control of civilian restaurants.

General Reference:

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"History of Restaurant Sanitation, Calcutta Area."

VII - WATER SUPPLY

1. Introduction

The provision of safe water supplies for the use of troops was one of the most difficult problems facing the technical services in the India-Burma Theater. The Corps of Engineers, with Medical Department supervision, had the responsibility of providing potable water for troops widely scattered in a country where contaminated water was universally consumed without question. Problems were found to exist whether military installations were located in large cities, rural communities, or in forward jungle areas.

The unsanitary habits of the people of India have resulted in virtually universal contamination of water supplies. Promiscuous defecation and urination are customary. The same water, whether it be in river, pond, or open well, is used for drinking, bathing and washing of clothes. Streams, or open ditches leading to them, are the customary disposal systems. Thus they receive a continuous supply of human and animal excreta, garbage, dead bodies and filth. Even in the large cities, the often primitive or unreliable disposal systems are used by but a small fraction of the population. With the constant pollution of all water sources it is not surprising that diarrhea, dysentery, and typhoid flourish. Cholera is endemic and severe epidemics occur annually.¹

Not only is surface water contaminated, but in those portions of India in which rainfall is heaviest, and where the majority of US troops were stationed, the ground water may be unsafe. During the monsoon season the water table rises close to the surface and with the almost constant pollution of the soil this supply is subject to contamination.

Two other factors complicated the problem of furnishing adequately treated water to troops. The majority of organizations were widely scattered over India and Burma. There were but few large bases with central water supplies. Supervision of the numerous and widely spaced small water supply sources was difficult. A second difficulty was the lack of adequately trained personnel to exercise technical supervision over water supplies. Although an earnest effort was made by responsible commanders and surgeons they were generally insufficiently trained in the technical aspects of water purification to provide satisfactory supplies.

2. Supervision of water supplies

During the early days of the Theater technical assistance in water purification procedures was meagre, and coordinated direction and education were not available. The first individual designated for supervision of water supplies was an officer of the USPHS. He was assigned to the office of the Chief Engineer, SOS, in early 1943 and remained on this job until October 1943.² During that time surveys of water supply systems were carried out and recommendations were made for their improvement. No other well trained technical personnel was available until 1944 when Sanitary Corps Engineer water specialists arrived. Ten of these men were assigned to the Air Transport Command and three to the far more numerous SOS installations. In September of that year one of the latter was assigned to the staff of the SOS Surgeon. The other two went to Section Surgeon's staffs.

Sharp improvement followed the arrival of these specialists. This was most noticeable at the ATC bases as would be expected from the talent assigned. Progress in the forward areas was slower than in the rear areas due to the greater problems encountered and because of an ingrown belief that boiling of water was the only safe water purification method in India.

The first coordinated action to bring about improvement in water supplies followed publication of the Theater directive "Sanitary Surveys of Water Supply Installations in accordance with AR 40-205," dated 12 July 1944.³ It initiated a program of periodic surveys of water installations, regular bacteriologic examination and training of operating personnel. Improvement, slow at first, became more rapid after permission was granted to use sanitary engineers assigned to other duty on a part time basis.⁴ A similar directive issued in February 1945 again called attention to these measures.⁵ The submission of reports of the surveys through command channels gave further impetus to the improvement program. The general availability of laboratory facilities, developed during this period, made possible the objective demonstration to commanders of defects present. Finally a circular, "Water Supply Sanitation," was published in May 1945 to clarify and establish standards of accepted water treatment procedures.⁶ Included was a provision that bacteriological tests be done at least once a month and reported in the monthly sanitary report.

3. Sources of Water

Ground Water Supply

The majority of the military installations in India were located in the broad flat alluvial plains of the Ganges and Brahmaputra Rivers where the natural geological formations furnished an adequate water bearing stratum. For this reason ground water supplies were widely used except in the forward areas and along the Stilwell Road. In many semi-permanent installations, wells and small distribution systems were constructed by the British Military Engineering Service, a civilian construction agency of the British Army. Standards were originally those of the British forces but were found to be inadequate for U.S. troops. The construction policy was therefore changed in 1944 to supply 42 Imperial gallons per person per day, a quantity which proved to be sufficient.

The wells were most commonly tube or drilled wells, with casings two to eight inches in diameter and from fifty to four hundred feet in depth. A number of gravel packed wells were constructed. Large diameter dug wells were necessary at a limited number of installations. Gravel and sand formations necessitated the use of screens to exclude loose material and to permit water to enter the tubes. The capacity of the wells varied from fifteen to sixty gallons per minute although a few yielded as high as 200 gpm.

Water was obtained from the wells by various types of pumping equipment. Hand pumps were used fairly frequently where the water requirements were low and the required lift small. More commonly used was the gas driven 55 gpm Jaeger centrifugal pump for suction lifts up to 15 feet. Deep well turbine pumps, Peerless helical rotor type, were installed in the larger drilled wells. Displacement type and improvised air lift pumps were occasionally utilized. Since water systems were in most cases designed according to British standards capacities were, at first, too low to supply the demand. Pumps often operated 18 to 20 hours per day resulting in breakdown and intermittent service. When the standards were raised much less trouble was experienced with pumping equipment.

The location, construction, and protection of wells did not always meet accepted sanitary standards since plans and specifications for construction were ordinarily not submitted for approval. Occasionally wells were located too close to latrines,

garbage dumps or in low ground into which drainage occurred during rains. Ordinarily concrete seals were provided but these frequently leaked about the casing. In a few instances the construction of pump pits necessitated by a low water table also created a sanitary hazard. The smaller wells were more subject to contamination than deeper ones penetrating impervious strata. Centrifugal pumps were attached directly by the suction end to the well casing. Any casing perforation or breakage about the seal would permit contaminants to be sucked directly into the well. In the case of the deep well a raised pump base was ordinarily erected. This was an improved construction but a common defect was the lack of or a faulty seal..

Surface Water Supply.

Along the Stilwell Road in Burma surface water was generally used. This was a combat and construction zone with many of the establishments being of a temporary type. Equipment and supplies were limited by transportation difficulties so that drilled wells using ground water could not be constructed. Streams were the principal source of surface water. They ranged in quality from a highly turbid river such as the Irrawaddy to relatively clear mountain streams. While the natives of these forward areas are sparsely distributed, their filthy sanitary practices rendered all surface water subject to contamination. Data is not available as to the pollutational load in these waters but the absence of sewerage systems, small native population, and the relative clarity of many of these waters indicate that it may have been less than that of the surface waters commonly used in the United States.

City Water Supply.

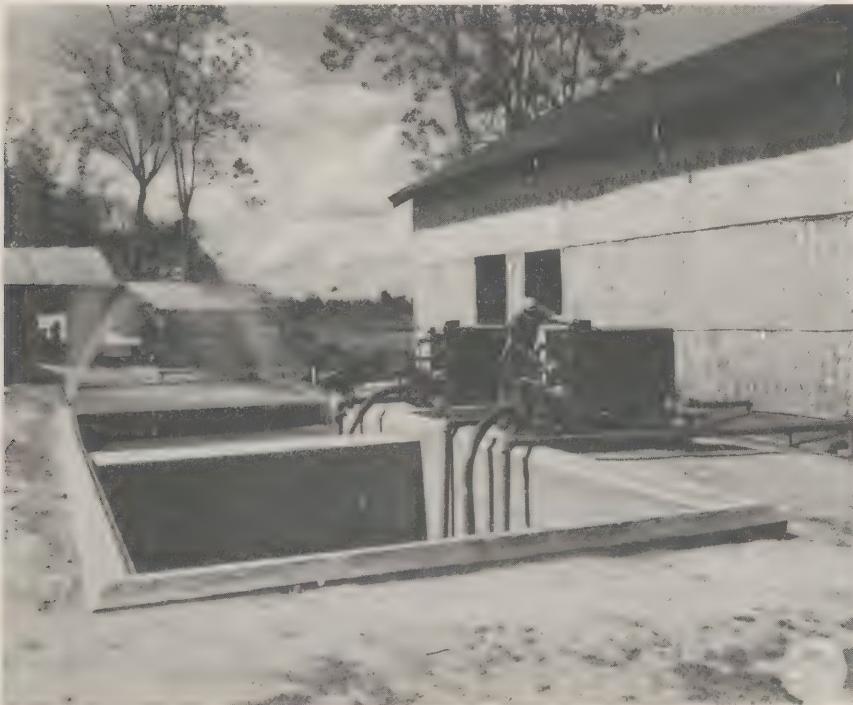
The only military installations which did not provide their own water were those in or adjacent to the large Indian cities of Bombay, New Delhi, and Calcutta. These cities are provided with purification plants permitting coagulation and sedimentation, slow or rapid sand filtration and chlorination. However, the safety of the water of at least two of these cities was open to question since the plants were often poorly operated and supervised. Chemical laboratory control was generally lacking and bacteriological analyses so infrequent as to be of no practical value. Some of the cities had dual systems, one supplying drinking water, the other untreated water for washing and bathing.⁸

Except in the case of New Delhi, rechlorination of water purchased from these city supplies was routinely required as residual chlorine was often lacking at the taps. Furthermore,



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Steam boiler and disinfectors at the 20th General Hospital. Two tanks on platform used to boil all drinking water for the 2000-bed hospital.



The pumping and water purification plant of the 20th General Hospital.

frequent contamination in the mains was probable because of low or negative pressures due to intermittent service. Contamination also occurred frequently in the storage tanks during the handling necessitated by intermittent service.

Combat Water Supplies

There were relatively few American troops under actual combat conditions as the principal mission of the Theater was the supply of China. Combat troops however, did engage in long range penetration missions mostly supplied by air drop. Conditions did not permit transportation of heavy water purification equipment. Water was secured from whatever source was immediately available. Usually surface water from small streams was used though open wells were employed occasionally. Lyster bags were set up except during actual combat or when the troops were marching. The water was purified by boiling or by the use of calcium hypochlorite tubes or halazone tablets.⁹

4. Treatment Methods

Chlorination



Water was chlorinated routinely in the Theater regardless of other methods of treatment. Chlorination was accomplished either in the distribution systems or in the final containers such as Lyster bags.

In applying chlorine to the water in distribution systems a number of different devices were used. Due to the early shortage of hypochlorinators, periodic hand chlorination in storage tanks was necessary. There was never any assurance that all water was reached by the chlorine when this system was used. In the Calcutta area jar solution feeders of Indian manufacture were often used. They were poorly constructed of inferior materials, dependable operation was difficult, and breakdowns were frequent. Also they could not chlorinate water under pressure, a distinct disadvantage. Water purification units were equipped with chlorinators which performed well but which were often used improperly.

Early in 1945 adequate numbers of automatic (motor driven) hypochlorinators arrived in the Theater. These were well suited to the use of any installation, having motor driven pumps and a well protected water source where filtration or boiling were not considered necessary. Their action was dependable and breakdowns were infrequent.

Lyster bags and other water containers were chlorinated directly, or the water was treated at a central point such as a well or boiling plant before distribution to the bags. The method of chlorination at a central point followed by subsequent distribution rendered the water subject to recontamination, particularly in those instances where it was handled by natives. In places where boiling was employed, the water was sometimes insufficiently cooled, thus dissipating the applied chlorine. In a few instances, as a result of lack of understanding of its purpose, chlorine was applied prior to boiling. In other instances it was omitted, as boiling was considered sufficient treatment. Because of these failures and the almost routine contamination of unchlorinated water in Lyster bags it was necessary to publish several directives requiring chlorination in the final container as the last treatment procedure in water purification.^{6, 10}

Lyster Bags

Experience with the Lyster bag revealed that it was subject to serious contamination by dust, leaves, insects, and other material washed by rain into it through the openings which admit the supporting ropes. Mosquito breeding was occasionally discovered in the bags. To protect against this type of contamination, the 69th General Hospital improvised a cone shaped cover placed over the supporting ropes. In 1945 this type of cover was adopted by the Quartermaster General as a standard item of issue.

Filtration

Three types of Army rapid sand filtration units were in use in the Theater. These were the portable, mobile, and semi-portable knockdown purification units. Varicus improvised supplementary equipment was utilized in most cases to facilitate pumping or storage. Most of the units were utilized in the forward areas where reliance had to be placed on surface water supplies. They were assigned to organizations according to their size, water requirements, and type of installation. Operation of the filters was poor in most instances. It was chiefly the result of lack of supervision of training of operators. No provision was made in the T/O & E for these purification units in many organizations which had to learn how to operate them by trial and error. Commanders frequently failed to realize the importance of proper operation to secure a safe water supply. Finally in some areas the policy of boiling all water gave rise to a fixed belief that the source and prior treatment of the water was immaterial.



Pipeline bringing water from Irrawaddy River to watertank and purification system at the 48th Evacuation Hospital in Burma.



An old abandoned steam engine used to boil drinking water for the 48th Evacuation Hospital at Myitkyina, Burma.

A Theater directive was published in July 1944 directing that special filtration procedures for removal of the cysts of E. histolytica be used. The procedures included use of a heavy coagulant dosage to give a rapidly settling floc, a minimum settling time of one hour, use of two sedimentation tanks and a filter output restricted to 10 and 60 gpm for the portable and mobile units respectively. 11, 12

The filtration procedures were not widely used in the advance and intermediate sections and operation of the units continued to be poor. Boiling of all water continued and few operators had been well trained. Some organizations produced water with a turbidity no lower than that of the raw water supposedly being treated. In some instances the chemical feed equipment was removed altogether indicating complete lack of understanding of the principles of water treatment.

Vigorous efforts to improve the training of operators was made when Sanitary Corps personnel was finally made available. Group training of operators eventually raised the standards of performance but this was not accomplished widely until late in 1945.

Boiling

The practice of boiling drinking water was adopted in the Chabua, Ledo, and forward areas among SOS installations from the time of activation of these sections. The widespread distribution of amebic dysentery, the known inability of the Army sand filters to remove cysts without accessory treatment, and the lack of personnel trained in the technical aspects of water treatment contributed to the adoption of the policy.

Water boiling equipment was developed which was almost as diverse as the number of using installations. It varied from 33 gallon GI cans heated over gasoline burners to four or more 400 gallon steel tanks heated by 35 HP steam boilers. One hospital even salvaged an old locomotive for this purpose. Heat was applied using gasoline, coal, wood, or steam coils. Because of the hot climate, cooling devices of various kinds were devised. Great ingenuity was shown by surgeons and engineers in improvising methods of boiling but the effort directed to the building of bigger and better boiling plants might better have been expended in properly protecting wells or other sources of water supply and improving the operation of purification units.

Boiling would destroy cysts and render the water sterile. Such benefits could not be demonstrated from the after treatment in many cases. Distribution to Lyster bags and kitchens was often done by native coolies with an attendant risk of recontamination. Cooling during the hot weather was often insufficient with the result that added chlorine was rapidly dissipated and objectionable tastes acquired from the Lyster bags. Raw water connections to large boiling plants might be left open permitting unboiled water to contaminate that already treated in the tank.¹³ Lyster bags or other containers were not always cleaned properly. The net result was that the boiled water more often than not was again contaminated by the time it reached the consumer. With proper handling, safe supplies could be provided but it required a maximum of effort and meticulous attention to detail, particularly in large installations handling great volumes of water.

5. Bacteriological and Chemical Examination

Until early in 1945 laboratories available for examination of water were insufficient and widely scattered. The 9th Medical Laboratory and the general hospitals were the only laboratories with sufficient trained personnel, equipment, and supplies to perform the work. The deficiencies in the smaller hospitals were eventually overcome after which they also became available for bacteriologic examination of water for the units in their vicinity.¹⁵ Where great distances separated the water source from the laboratory regular shipment of water samples was employed.

The surveys initiated by the directive "Sanitary Surveys of Water Supply Installations in Accordance with AR 40-205" in July 1944 uncovered many deficiencies. The water from over half the sources examined in Intermediate and Advance Sections was not potable.¹⁵ This finding was followed by vigorous efforts to improve the supplies and by the spring of 1945 non-potable samples had dropped to 10 to 15 percent. Further improvement followed the Theater circular, "Water Supply Sanitation" of May 1945. Eventually only occasional samples were non-potable. Corrective action could then be easily taken.

Because of the widespread fear of the spread of amebiasis by drinking water, the policy of boiling, as discussed above, was instituted. Chang had published a paper in January 1944 showing that amebic cysts could be killed by as little as 2 parts per million of residual chlorine.¹⁶ This paper did not attract much attention at first. When it was noted, officers were generally skeptical of the report. In late 1944 the



CB1-44 24834

Drinking water boiler at 14th Evacuation
Hospital



Water boiling plant at 1st Convalescent Camp



Water pumping station at river bank, 14th Evacuation Hospital
(Assam, near Ledo)



Chlorinating and pumping station, 14th Evacuation Hospital
(Assam, near Ledo)

9th Medical Laboratory set up experiments to test Chang's results, using cysts obtained directly from human hosts, rather than cultured cysts. These experiments showed that concentrations of 5-10 ppm with contact periods of 30 to 60 minutes would not kill all cysts.¹⁷ This finding, of course, added fuel to the fires under the pots of boiling water. Later the results were confirmed in the United States. Actually the finding meant only that, except for superchlorination followed by dechlorination, chemical methods could not be relied upon to render water completely safe. It did not imply that other treatment methods when properly applied were useless in purifying water.

A new water sterilizing agent, Bursoline, an iodine containing agent, was recommended to the Theater in early 1945 with the request that it be tried on a large scale under field conditions.¹⁸ Unfortunately no large body of troops was available living under the prescribed conditions for a suitable test. Published reports indicated that it was highly cysticidal, a property confirmed by the 9th Medical Laboratory in preliminary tests. Developed and supplied earlier it would have been distinctly advantageous for combat troops as well as travellers depending on their own canteens for drinking water.

6. Special Problems

Rail Travel

Many troops after landing in India were faced with long rail trips to reach their final destination. These journeys lasted from three to 10 days or more, depending on points of origin and detraining. Water supplies along the route of travel were considered unsafe although no careful large scale investigation of these sources was conducted until 1945. It was then concluded that the majority of supplies derived from wells would be relatively safe after chlorination. Prior to this, water for troop movements had been supplied in British 10 or 16 gallon tanks or 5 gallon American water cans. Rarely did the supply last through the trip. Boiled water was prepared at stations along the way whenever possible. Sometimes hot water could be obtained from the locomotives although it was usually unpalatable. At other times the cans were refilled from dubious sources, the water being chlorinated by hand.

Some troops made part of the journey on river boats up the Brahmaputra River. Drinking water on these vessels was grossly inadequate as a rule, often consisting of raw river water treated directly with hypochlorite.

Eventually the lack of coordination between the various agencies dealing with troop travel was corrected. Canteens and halazone tablets were required to be carried by all troops. Arrangements were made for water supplies which would be safe after treatment with the tablets and adequate stocks of the tablets were made available along the way.¹⁹

Bottled Drinks

The physical appearance and bacteriologic examination of many brands of civilian bottled drinks indicated that the products were often unfit for use and that much supervision was needed. Under careful supervision a few of these were permitted to be used. A number of Army Coca Cola bottling plants built to supply troops were provided with equipment for the treatment of all water used in the process of manufacture. Sanitary washing and rinsing of the bottles and care throughout were insisted upon. The product of these plants routinely met bacteriologic standards.

7. Summary and Conclusions

Dysentery, cholera, and typhoid fevers are highly endemic in India. Much of the water in the country is contaminated with the organisms of these diseases and the remainder is potentially so. Water purification therefore was a problem of great importance.

For the greatest part U.S. troops were scattered in numerous installations and had to supply their own water. In India units were located chiefly in the alluvial plains of the Ganges and Brahmaputra Rivers. Ground water sources, using drilled or tube wells, were employed for the most part. Adequate supplies of water were obtained which with reasonable care were of good quality. A few city water supplies were used. These were frequently inadequate in quantity and unsatisfactory in quality. Rechlorination before consumption and supplementation with a camp supply were generally necessary.

Along the Stilwell Road and in Burma surface water sources were commonly used. Army rapid sand filtration units, supplied to the organizations in these areas, were generally used improperly because of lack of confidence and shortage of skilled operating personnel. The routine boiling of water in these areas was therefore adopted. Once this policy was established laxness in other purification procedures appeared. The policy was never entirely uprooted although good progress in this direction was being made at the time the war ended.

Sanitary engineering is an essential preventive medicine function, but because it is comparatively new in the Army, its possibilities in water supply supervision were not utilized to the fullest extent. A sanitary engineering organization was not established until late in 1944 and much of its effectiveness was lost in trying to correct errors and omissions in original design and procedures. In the India-Burma Theater an efficient water sanitation service was not established until the summer of 1945.

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VII - WASTE DISPOSAL

Throughout most of India the only means for collecting and disposing of human excreta (except that dropped indiscriminately by the roadside) is the bucket system.^{1,2,3} Containers of "night" soil are emptied daily by "sweepers" and the excreta dumped at some convenient spot outside the city. Only a few of the modern urban areas of India which have abundant water supplies have installed flush toilets.

Due to the insanitary nature of the bucket system this method could not be accepted,⁵ even in a land where nothing better was expected. It took considerable insistence on our part to insure the use of pit latrines as an alternative to flush toilets in quarters built for us on reverse lend-lease.^{1,4}

The use of pit latrines was the preferred method of human waste disposal at American installations in the Theater unless a water borne sewerage system was available. Even in forward areas the open straddle trenches were used only temporarily and a pit latrine with hinged covered box seats was substituted at the earliest possible date. The latrines were usually covered as protection from rain and sun and made relatively fly proof by side walls of hessian cloth, or less frequently by screening. During and after 1944 the latrines presented, on the whole, an excellent picture of cleanliness and fly proofing. The best types were dark because of the heavy hessian cloth used for screening, were well impregnated with D.D.T. spray, and gave rise to remarkably little fly breeding.

In certain areas, particularly during the rainy season, the water table was so high that pit latrines would fill with water. In some instances oil drums with upper ends removed were sunk under the holes so as to hold out the water, but their capacity was so limited that they were not entirely satisfactory. Another method of latrine construction in water-logged areas was to heap up a mound of earth and construct the latrine at its summit so as to keep the entire pit above the water table. Oil drums with both ends removed were occasionally used as pit casings in the mound latrines.

Liquid waste from wash and shower rooms and kitchens was handled in a variety of ways, according to location. In the desert climates as around Karachi, evaporation beds were constructed adjacent to the wash rooms or the kitchens. The evaporation beds consisted of shallow pits within which the soil was stirred

and drawn into ridges. Waste water would be run into one bed until it was well soaked, and then it would be diverted into an adjacent bed. In some locations each evaporation bed was labeled with the name of one of the days of the week - the day upon which it was to receive the waste water. Where drying was rapid and the organic content of the water relatively low, there was neither odor nor fly breeding in these beds.

In other areas waste water was either directed away from the camp by surface drainage, or was run into soakage pits. The methods used were adopted to the local conditions of soil texture, drainage, or climate.

Solid kitchen waste was, for the most part, buried. In a few instances attempts were made at incineration, but a supply of fuel for this purpose was usually difficult to obtain. Garbage disposal in most instances was accomplished by the separate organization, each having its own garbage pit where such waste was dumped daily and then covered with earth. In large camps areas which were well established, central garbage pits or disposal areas were maintained and the kitchen and mess hall wastes were trucked to and dumped at these points.

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1. Tamraz Diary, Page 5, 2 April 1942. Camp Malir, constructed by the British, is to be turned over to U. S. troops. In the hospital still under construction, no toilet facilities are provided. The excreta are to be collected by sweepers and deposited in septic tanks. The toilets had been fly proofed. Pit latrines were recommended since it is stated that there is a shortage of water for flush toilets.
2. Tamraz Diary, page 46, 8 August 1942. At the Ramgarh training camp. Chinese care nothing for cleanliness and sanitation, defecating any and everywhere. Toilet facilities are adequate but are not used.
3. Tamraz Diary, page 58, 30 August 1942. On a train trip, Karachi to Delhi. The filth, dirt and smell in most of the railroad stations is appalling. It was a frequent sight to see children being allowed to defecate right on the platform.

4. Letter, Surgeon SOS to CG SOS 5 Sept 1942. "Accommodation for US troops in India", refers to British troops hutted scales and specifications and states that "acceptance of such standards means acceptance of bucket latrines..... and other specifications not hitherto accepted by American forces and which would result in latrine and other housing conditions not in accordance with standards necessary to protect the health of our troops."
5. Letter, Hq SOS to CO Adv Sect #2, Chabua, 17 February 1943, "Latrines", states that bucket type latrines should not be installed but that pit type latrines should be built.

VIII - LOUSE CONTROL

Louse borne diseases did not occur among American troops in the India-Burma Theater, nor was there any reported lousiness among Americans. However, a number of cases of epidemic typhus and of relapsing fever were found among Chinese troops who had entered the Theater in the summer of 1944 from China.¹ Chinese recruits flown over the Hump to Assam were usually lousy. The delousing procedure consisted of bathing with kerosene-soap solution, the application of sulfur ointment (scabies), and the issue of clean clothing. Usable clothing removed from troops one day would be steamed, dried and then re-issued to other troops the following day.² For the most part the recruits arrived in rags and there was no hesitation in burning the discarded clothing.

Although comment was made 9 August 1944 in a letter to the Theater Surgeon by the Theater Epidemiologist that a large supply of individual size cans of louse powder was on hand in the Theater and that the new item should be used liberally, this plan appears to have been too simple to be considered and a great deal of inter-office correspondence extended over the subsequent two months as to the relative merits of shipping to China a 74 ton chemical impregnating plant requiring 1 ton of supplies daily, of impregnating clothing at Ledo or of shipping the clothing to China to clothe incoming troops. There was also comment on obtaining hand dusters for applying DDT powder.

The passage of time rather than specific action appears to have effected a satisfactory solution to the problem. Probably a more careful screening of troops in China prior to their shipment to India as well as a marked decrease in such troop movement, were the principal factors involved in reducing the incidence of louse borne disease among the Chinese.

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2. Letter, Hq Adv Sect #2, SOS, to CG SOS Adv Sect #2, USAF CBI, 19 August 1944, "Delousing Chinese Troops".

The Theater was requested by letter of 14 March 1945 from Hq, ASF¹ to supply information regarding rodent prevalence and control measures.² This information was obtained from the separate sections of the Theater and from the services (AAF and ATC), and was forwarded to The Surgeon General on 25 June 1945.³ On the possibility of an outbreak of plague or other disease spread by rodents or their ectoparasites, a plan for Theater-wide rodent control was drawn up ready for use should the occasion arise.⁴ Advance Section, IBT, which was located adjacent to an area from which an outbreak of plague had been reported, published information 11 June 1945 to all unit commanders on the subject of Rodent and Flea Control,⁵ and to all unit commanders and all surgeons on the control of plague.⁶ Fortunately, plague never became more than a temporary threat to our troops and it was not necessary to institute any Theater-wide rodent extermination program. Local measures for the control of rodents as pests continued throughout the existence of the Theater and were adequate for the protection of American stores.

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X - TROOP MOVEMENTS

1. Movements by Railroad

Transportation in India is not unified into a national system. It developed on the basis of local need--roads, railroads, and water routes spreading out from such centers as Bombay, Calcutta, Madras, Lucknow, and Lahore. Eventually these separate systems joined and this made possible, but not convenient, the movement of persons and goods from one center to another.

The railways of India are of three widths, mostly either broad gauge (5'6") or meter gauge (3' 3 3/8"), but with a number of small local railways of narrow gauge (2'2" or 2'6"). A trip of any extent would often require changing from one to another gauge railway. The large rivers are often unbridged and must be crossed by ferry. Highways are poorly surfaced and are for the most part built to care for local needs only.

The loss of Rangoon as the terminus of the road to China made necessary the establishment of a new route. The next nearest major port was Calcutta, but no railways or highways existed between India and Burma except for a devious trail through Imphal. It was decided to open a new route to China by building a road via Ledo and the upper valleys of the Chindwin, Irrawaddy, and Salween Rivers to Kunming. Both personnel and supplies had to be accumulated for such an undertaking. The sea route to Calcutta was considered too dangerous for troop ships since Japanese submarines began operating in the Bay of Bengal, even to the extent that freighters waiting their turn at the mouth of the Hooghly River, entrance port of Calcutta, were attacked. Troops and supplies were therefore first landed at Karachi where the U.S. Army Air Forces had already established a station and then at Bombay, as soon as docking, warehousing, and staging facilities could be provided. Both Karachi and Bombay are on the West coast and all troops and supplies landed at either port had to be shipped across the width of India. Every means of transportation, as well as docking and warehousing space, was used to the limit of its availability. Supplies unloaded at Calcutta required a much shorter haul and were shipped through this port in increasing amounts as the dangers from enemy action decreased, but not until the fall of 1944 was there extensive troop debarkation at Calcutta.

The trip from Bombay to upper Assam, which was the designated area of troop concentration, crossed about 2000 miles of India and involved, often, a wait of several days in Bombay staging areas, a rail journey in Indian trains to the Calcutta area, possibly a period of time in another staging area, then a rail or a rail-boat-rail journey to Assam. Bombay to Calcutta took about 5 days; Calcutta to Ledo (the rail-head) from $2\frac{1}{2}$ to 5 or 6 days. Units, crossing India seldom escaped having some of their number hospitalized at the end of the journey. Malaria and intestinal diseases were responsible for most of illness. The railway followed river valleys in which malaria was seasonally epidemic among natives. Native population, along with disease-producing filth and absence of sanitation, were concentrated along these railways, particularly at points where stops were made. Personnel enroute were not always sufficiently instructed or adequately supplied to protect themselves from infection.

When troops were held over in the Bombay area awaiting rail transport, they were assigned to one or another of several camps in the vicinity. The use of these camps was furnished by the British who supervised sanitation. A sanitary inspection of Camp Deolali made 29 June 1943,^{1,2} found kitchens to be dirty and full of flies with food and utensils unprotected. The mess halls had no screens and flies were on tables, utensils, and exposed food. "A good percentage of our men are now on the sick list, affected with diarrhea." Latrines were of the bucket-type, were carelessly maintained, and swarmed with flies. As a consequence of this inspection the commander of the Base Section recommended to the Commanding General, SOS, that all troops be landed at Karachi rather than at Bombay,³ but no action was taken at that time.

The railway coaches of India are either first and second class, or third class. First class coaches are divided into compartments which are comfortable and roomy. Windows are usually left open unless the coach is equipped with ceiling fans. The third class coaches have only a single large compartment into which all the passengers are placed, seated on benches against the wall or in the middle. There is no air cooling for third class.

It was difficult to apply anti-malaria measures under such conditions. Mosquito nets could be used in the first and second class compartments, but not in third class. On night stops during the monsoon season mosquitoes would swarm into the coaches

through the open window. If insect repellent and aerosol dispensers had been supplied at the beginning of the trip, such supplies were soon exhausted and there were no reserve stocks to draw on. A malaria incidence of as high as 1/3 of their personnel was reported by some units to have occurred within two weeks of completing the journey.

No sanitary control existed over train-side venders and station restaurants. Rations issued troops for the journey were frequently insufficient and often unacceptable. In spite of orders to the contrary, food was often obtained from unauthorized sources and its consumption resulted in intestinal infections. Some improvement was made by attaching a British mess car to each train but both the quality and preparation of the food was poor by our standards. Facilities for washing and disinfecting mess gear had to be improvised. Some troop commanders brought GI cans to the locomotive and had them filled with hot water from the boiler. When on board a river boat, raw river water had to be boiled on cook-stoves for mess kit washing. There was little or no control over water sources for drinking. The water carried by railways in the coaches could not be used because of almost universal contamination. Coach water tanks were sometimes filled from goatskin bags by natives. Measures for the prevention of disease among troops in transit were hampered by shortages of supplies, by inadequate preparation, or briefing, of those making the trip, and by not having close enough medical supervision and command control of troops enroute. The above conditions regarding protection from mosquitoes and the provision of water and food while enroute were encountered by the first U. S. Army units traversing India by surface transportation.

Specific measures were taken from time to time but it was over a year before planned supervision of all health factors was in evidence. In the fall of 1943 recommendations were made⁴ that GI cans be furnished troops in transit for cleansing mess equipment and that arrangements be made with the British to heat water for this purpose. Recommendations were made by base section headquarters regarding the possession and use of mosquito nets by personnel travelling by train and measures were taken to insure the receipt of antimalaria supplies by individuals and casual groups.⁵ A memorandum including provisions for the supply and use of antimalaria and other sanitary materials was published 29 December 1943.⁶ Reports of sanitary inspectors of troop movements made in October,⁷ November,⁸ and December⁹ of 1944, showed that measures already taken by ports of debarkation and base sections¹⁰ were not sufficient to insure proper observance of sanitation. Recommendations included the suggestion that a service car containing all

sanitary supplies needed for the trip together with water purification and mess kit water heating facilities, be provided each train, but this was not approved.¹¹ Troop cars were mosquito-proofed, but the wire screen placed over windows did not remain there.¹² It was decided that mosquito-proofing was not practical and that main reliance for malaria control for troops in transit was to be placed on the use of repellents, insecticides, and the wearing of proper clothing.¹³ Troops enroute to and from rest camps encountered insanitary conditions¹⁴ which were gradually corrected by appropriate regulations.^{15, 16}

The first Theater-wide directive providing for sanitary control of troops in transit was Transportation Service Circular No. 1, on "Transportation Procedures"¹⁷ published 10 August 1945. This circular provided, among other things, for sanitary supervision of water supplies, mess kit washing, and food supplies. This circular was published just as the war ended and was in time for the extensive troop movements which followed. Special health problems incidental to redeployment were anticipated¹⁸ and measures taken to make the train trip across India as free from health hazards as possible.^{19, 20, 21, 22} Adequate sanitation supplies throughout the trip were provided and the responsibility for their effective use insured by Transportation Service directives.

Because of a limitation on marine port facilities available to U.S. forces in Calcutta, it was decided to utilize Karachi up to its capacity for both marine and air evacuation. The entire redeployment program required careful synchronization. The speed with which the Theater could be emptied depended in final analysis on the availability of troop ships. The limitation on staging area capacity made it necessary to feed troops into the ports at a rate which would not overload their facilities. Because of large stocks of food and medical and sanitary supplies in upper Assam, there was no strain on the Quartermaster supply system in handling this movement.

Port facilities at Calcutta had been expanded during the last year of the war so that by the time hostilities ceased they were receiving practically all of the marine traffic for the Theater. Consequently it was estimated that about 3/4 of the Theater troops could be embarked via Calcutta. Karachi, on the other hand, had been almost abandoned as a marine port except for supplying of troops stationed in the immediate area. However, it was maintained as the chief port of aerial embarkation and debarkation for the Theater. The Air Transport Command operated planes to and from the ZI via the Persian Gulf, North Africa, and the Mid Atlantic routes. Staging facilities for troop capacity of 16,000 remained under USF control at Karachi, administered as a Replacement Depot.

As the Theater evacuation plan evolved, it was decided to utilize air transport for personnel up to its full capacity both from advance areas to Calcutta and Karachi, and from Karachi to ZI. Supplementary rail transport would be provided to maintain a satisfactory troop level at port staging areas. Air lift of troops presented no special sanitary or medical problems. The brief time in transit made unnecessary any provisions except those already in force at the various flying fields. The sanitation of such locations was well established.

In late 1945 the rail route from Assam to Calcutta was well established and policed. Troop health was protected by control of water points, the provision of rations and the replenishment of anti-malaria items enroute.

Although air lift was to be used to supply Karachi port of debarkation with a large proportion of its evacuees, it was necessary to ship some 20,000 troops by special military trains over the "northern" route. This involved a 2470 mile trip from Assam to Karachi, 2000 miles of which was over a route not previously used for major U. S. troop movements. Since responsibility for providing adequate medical service and supplies and making other provisions for health of troops entrained had been delegated to commanders at the point of origin,¹⁷ a letter was sent the Commanding General of Intermediate Section discussing in detail the medical preparation for the health measures advised for such a troop movement.²³ As the trip involved about 10 days travel, suggestion was made that a break be provided at a convenient point enroute (such as at the trans-shipment station of Lucknow, meter gauge to broad gauge), by providing messing and shower facilities.²⁰ A letter report of an inspection of this trans-shipment point after it had been in operation several days describes the sanitary provisions of this station.²⁴

The favorable health record of troops arriving at Karachi by rail from Assam is an indication of the adequacy of the medical and sanitary preparation for this troop movement. During September the number making the trip was 5846, of which 47 were hospitalized for various causes only a few of which could be attributed to the rail journey.²⁵ During October a total of 7986 troops arrived in Karachi by rail of which 109 were hospitalized. The chief causes for hospitalization were respiratory infections 24, intestinal diseases 18, malaria 16, venereal diseases 9, injuries 9. Practically all the malaria cases were admitted on 11, 12, 13, 22, and 25 October and may in some instances have been contracted on the trip. During November 97 out of 4632 troops arriving by trains

were hospitalized, chiefly for respiratory infections 19, intestinal diseases 12, venereal diseases 11, malaria 4 and injuries 4, with there being no evidence that any of these were due to the train trip. ²⁶

2. Motor Convoys. ²⁷

Convoy operations on the Ledo Road began as soon as the first leg of the route was open for traffic. Building at the road head required a continual stream of equipment, materials and supplies. For convenience these materials were grouped into unit shipments each transported by a convoy of trucks. The personnel of each convoy at first carried everything they were likely to need for the trip- bedding, jungle hammocks or mosquito bars, water, rations, and first aid supplies. As the road lengthened, control points were established along the route at distances of a day's run each, and transient mess halls were built at these points. Convoy commanders were responsible for the enforcement of malaria control measures. Medical care, when required, was furnished by the dispensaries of the engineer maintenance or construction units along the route.

With the juncture of the Burma and China portions of the road 28 January 1945, China bound convoys were organized. These convoys usually consisted of about eighty loaded vehicles including an ambulance, and took from 10 to 20 days for the trip, Ledo to Kunming. The drivers were at first volunteers, either American or Chinese, but so many vehicles were lost that the use of volunteer drivers was discontinued about 1 June 1945 and regular QMC truck drivers were used. About 100 men were assigned each convoy. After delivering the convoy in Kunming the personnel were flown back to Ledo.

During the period of volunteer drivers a Medical Officer was assigned each convoy. He travelled in the ambulance and carried a chest of medical and sanitary supplies. This chest was returned to Ledo by air for re-issue to the next convoy. Upon discontinuing the assignment of a medical officer to each convoy an ambulance company was stationed along the road and was called by telephone to scenes of accidents. A series of dispensaries and hospitals were located along the road so that no point was much over fifty miles from a medical installation.

During the early period of China convoy operations, the convoys would bivouac each night at some convenient spot along the road. They had to replenish their water supplies along the way, had difficulty in obtaining fuel, and found it inconvenient to boil, cool, and chlorinate water for their own use.

Permanent overnight camp sites were established 1 April 1945. They were equipped for water purification and storage, and furnished water for showers, cooking and drinking. Wherever practicable, transient messes were operated and sufficient personnel was assigned for their operation. The cooperation of the convoys in maintaining required standards of sanitation at the transient camps was insured by making the convoy commanders responsible for policing each camp site prior to their departure and by requiring clearance by the station commander.

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1. Letter, Office of the Surgeon, Deolali Transit Camp, 29 June 1943, "Sanitary Reports on Camp Conditions", describes complete absence of sanitation in the kitchens, mess halls, and latrines of the camp where there was no evidence of sanitation among employed natives.
2. Letter, Bombay Office, Base Section No. 1, CBI, 30 June 1943, "Sanitary Report on Camp Conditions", states: "This headquarters is cognizant of the difficulties found in the procurement of supplies to relieve conditions outlined. Our officers must realize that conditions found in this country are not to be compared with the United States."
3. 1st Ind. to ltr, Bombay Office, Base Section No. 1, CBI, 30 June 1943, "Sanitary Report on Camp Conditions, Ind. dated 7 July 1943, Hq Base Section No. 1, SOS USAF CBI, recommends that all troops be landed at Karachi rather than at Bombay. (Note: as late as 23 January 1945 a shipload of 5000 troops landed at Bombay).
4. 4th Ind. to Ltr Report of Sanitation on troop train enroute to APO 884, dated 20 Oct 1943, from 181st General Hospital, recommended 3 GI cans be supplied in cleaning mess kits, and arrangements be made with British N.C.O. and mess officer to heat the water for mess kit washing.

5. Ltr, Hq Base Section 1, SOS USAF CBI, Office of the Surgeon, 23 December 1943, "Malaria Control on Rail Movements."
6. Memorandum, Hq Base Section 1, SOS USAF CBI, 29 December 1943, "Standard Operating Procedure for Troop Movements by Rail from Base Section No. 1."
7. Medical Officer's Informal Report of Troop Movement by Rail, Special Train 205C, APO 881 - 10 Dec 44 to APO 689 - 21 Oct 44 (11 days) (76 officers 726 EM). Diarrhea 37, foreign body eye 49, lacerations 171, trichophytosis URI 19; "lack of any definite organizations with regard to water and sanitation. Would suggest that a representative of the Port Surgeon make one trip to see what problems arise so that the train surgeon may receive more specific instructions."
8. Sanitary Survey of Train Trip from Calcutta to Chabua, Assistant Division Malariaologist to Divisional Surgeon, 1300 AAF Base Unit, ICD-ATC, APO 192, 15 November 1944, describes in detail protective measures taken or not taken, both in preparation for and on the trip; malaria, food, and water.
9. Report of Sanitary Inspection of troop movement, 1 December 1944, Hq Advance Section #3, APO 689, describes conditions on a trip Calcutta to Ledo in detail, with recommendations. 1st Wrapper Indorsement, 2 December 1944, Advance Section #3, offers suggestions for consideration regarding troops movements across India.
10. "Immunization Memo," "Instructions to Train Surgeons," "Brief of Train Commander," "Brief of Car Commanders;" Port of De-barkation, Transportation Service, APO 881, (Inclosures to 1st Ind., dtd 9 February 1945, to Ltr, Hq Transportation Service, Sub: "Report of Sanitary Inspection Troop Movement," 25 January 1945).
11. Report of Sanitation Inspection of Troop Movement (Calcutta to Ledo) by Kremer dated 1 Dec 1944; Supply Service car is proposed. Answering letter from Hq Trans Serv is not in favor of supply service car. States river steamers withdrawn December 1944 and troop cars being mosquito proofed.
12. Letter from GHQ (India), "Anti-malarial measures for personnel in rail transit," 5 March 1945, states a complete train of wire screen mosquito proofed carriages inspected 6 Feb 1945 and no window of the entire train had intact screen. Reason: theft by civilians of entire screen or puncturing holes by bayonets or rifles. Indorsed 9 April 1945, SACSEA.

13. Letter, Hq USF IBT 13 June 1945, states mosquito proofing of trains not practical and main reliance should be placed on use of repellents, insecticide sprays and wearing proper clothing.
14. Memo to Theater Surgeon, 25 June 1945, "Rail travel from Khanspur Rest Camp", describes insanitary conditions on 2 rail coaches furnished for return trip of 16 Officers and 40 men. It was un-iced. No water was supplied. No water points enroute were approved for use. EM had water in canteens and water purification tablets but ran out of both water and tablets on the trip.
15. Letter, Hq. Transportation Service, 2 July 1945, "Movement of Rest Camp Personnel", outlined duties of RTO's at rest camp rail heads and RTO's entraining personnel for rest camps. These included sanitary inspections, and measures such as requiring train equipment to be cleaned, watered and disinfected prior to entrainment, requiring supply of rations, ice and drinking water, and information as found in British Movement Control orders, where ice and water would be replenished enroute. RTO's entraining personnel for rest camps were to check supplies of insect repellent and aerosol bombs. (1 bomb per 20 men).
16. Circular No. 75, Hq USF IBT, 5 July 1945, "Travel Precautions".
17. Circular #1, Hq, Transportation Service, Sub: "Transportation Procedure", 10 August 1945, assigns responsibilities of local transportation officers travelling Inspectors, Train Directors were given responsibility to determine that water for drinking purposes is properly purified, boiling water is provided for washing mess utensils, that military standards of cleanliness be maintained and that food, water and other supplies be taken on at designated stations. The Troop Train Commander was to issue orders prohibiting troops from washing mess kits in drinking or bathing water or in lavatories, purchasing food or beverages from vendors or stations enroute, consuming water not inspected by medical officer in charge.
18. Memo for Chief Staff from Theater Surgeon, "Evacuation of Troop by Train", 4 September 1945, stated that the Assam-Karachi rail route had not been properly surveyed from standpoint of disease prevention and said hazard of malaria and heat exhaustion existed and that troops would be without

prepared meals, sleeping and bathing facilities for 9 to 10 days. An observer was offered by Theater Surgeon to ride the first train and a liaison officer was made available to assist with medical and sanitary preparations at Chabua.

19. Check slip from QM to G-4 thru Surgeon, 5 September 1945, Issue of Fruit Juices, states that trans-India Assam to Karachi troop movements are being furnished 10-in-1, K & C rations plus an emergency reserve to cover delays and proposed issue fruit juices to supplement water supplies.
20. Letter Report, Sanitary Conditions Lucknow Troop Transhipment Point, 7 September 1945, recommended a kitchen serving hot meals, together with shower facilities to be established on a trainside platform in Lucknow, so each trainload of troops would get a break on their trip.
21. Check Slip from G-3 to Theater Surgeon: "Check list for medical requirements". Inspections of category IV units prior to departure from home stations is proposed, and suggestions for items to be checked are requested. 1st Indorsement, 26 September 1945, Surgeon's Office, suggests check on immunizations, medical inspection, and sanitation supplies (Atabrine, aerosol bombs, mosquito nets, repellent, and halazone tablets.)
22. Check Slip from QM to Surgeon, 2 October 1945, "Travel Rations", requested comments reference serving non-cooking complete B rations. Remark No. 2 of 2 October, Surgeon's Office, advised that such would be dangerous to health due to absence of facilities for sterilizing utensils or preserving and serving foods. "The outstanding health record and lack of diarrheal diseases in the present Chabua-Karachi troop movement are attributed largely to the use of individual rations.
23. Letter, Surgeon, IBT, to CG Int Sec, 7 September 1945, discusses health measures advised for troop movements Assam to Karachi. These included proper chlorination of all water, prohibition of ice in drinks, adoption of AST from alert to release in ZI, enforcement of malaria discipline (clothing use of repellent), spraying of cars and 3 times nightly use of aerosol, consumption of government issue or supervised food only, provision of one hot meal and a shower enroute, attendance of one medical officer, provision for a hospital compartment (4 berths) and a medical kit, and use of extra salt in diet from Lahore to Karachi (desert area). A list of station hospital facilities enroute was supplied.

24. Letter Report, Hq USF IBT, Office of the Surgeon, 29 September 1945, Medical and Sanitary Facilities of Lucknow Troop Trans-shipment Point. A mess kitchen, showers, latrines, post exchange and Red Cross facilities were established on a railway station platform, 900 feet long. A permanent party of about 44 officers and men including mess personnel and a medical officer operated the trans-shipment point (meter gauge to broad gauge). The mess section of the platform was screened and equipped with 6 ranges, 2 sets of mess kit washing cans with immersion heaters, 2 ice boxes, and garbage cans. The Red Cross kitchen had an automatic doughnut machine and served coffee in paper cups. The city water was chlorinated in refilled water cans. A canvas enclosure with 24 shower baths and additional taps for washing and laundry was provided. Deep pit latrines were placed at the end of the platform. Fly control was carried out through screening and the liberal use of DDT residual spray. The arriving cars (meter gauge) had all been sprayed with DDT at Tinsukia before starting; the cars of broad gauge trains were DDT disinfected previously. If on schedule, troop trains arrived at 0615, were served breakfast and dinner, had the forenoon for cleaning up, resting, and transferring equipment, and departed about 1450 hours.
25. ETMD report for September dated 20 October 1945, Hq Base Section IBT 181st General Hospital. Out of about 6,000 troops, (1 train daily for ten days, then 1 train each alternate day, 500 troops on each train) shipped across India (Assam-Malir) by troop train arriving September 17 to 30, there was a total of 47 hospital admissions, of which 14 were for diarrhea, dysentery, or gastro enteritis. "In only two cases can the diarrheas be attributed or charged to the troop train." Only one case of heat exhaustion was encountered, but this occurred subsequent to arrival.
26. Telephone report, 181st General Hospital, about 1 December 1945.
27. "History of Medical Section, Motor Transport Service, Advance Section, IBT."

HISTORY OF PREVENTIVE MEDICINE

USAF - IBT

PARTS III & IV

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* Prepared in Statistical Section, Office of the Surgeon, IBT.

PART III - SPECIFIC HEALTH MEASURES

XI. IMMUNIZATION

1. General Discussion

Immunization against certain diseases is an integral and exceedingly important part of any preventive medicine program. This is especially true in India where smallpox, cholera, and typhoid flourish unchecked in the native population crowded in upon the troops. With the possible exception of smallpox, the immunization program in our forces may be said to have been successful. Certainly it may be affirmed that India-Burma troops were exposed to the pestilential diseases more intensively than elsewhere. The relative importance of immunization as contrasted with the preventive value of sanitation cannot be evaluated accurately from our experience. Both are essential if large military forces are to remain effective in an environment as hostile to health as was the India-Burma Theater. The low incidence of these diseases, except smallpox is evidence that a well balanced program of sanitation and immunization may be relied on to keep armies on their feet even in such countries as India and China.

No particular problems were encountered apart from the difficulty of securing 100% immunization to smallpox. This objective should have been reached considering that we were dealing with a military population and there was no necessity for economizing on the vaccine. The occurrence of forty cases of smallpox with 10 deaths in the India-Burma Theater is a testimonial to Medical Department carelessness in handling and employing smallpox vaccine.

The first Theater-wide directive dealing with immunization was published by Headquarters Rear Echelon USAF CBI on 1 October 1942.¹ It prescribed revaccination against typhoid, cholera, and typhus every six months and against smallpox every three years. The months of April and October were designated for the semi-annual injections and this practice continued during the life of the Theater. An improved immunization form was printed and distributed during November 1942. On 17 August 1943 Circular No. 50 Headquarters Rear Echelon USAF CBI changed the smallpox reimmunization period to "every six months".² This practice continued until early 1945 when it was changed to one year by Circular No. 5, Headquarters USF IBT 20 January 1945.

2. Smallpox

India has the highest smallpox rate in the world. The disease is endemic throughout India but is especially prevalent near Calcutta, in Northern Bengal, and Eastern Bihar. An annual average of 30,952 deaths is reported between 1932 and 1941. There is a clear cut smallpox season

in India starting in January and lasting until May of each year. The incidence in American troops followed this pattern closely as will be seen from the accompanying figures.

As part of its overall program of disease prevention, the Army required smallpox vaccination of all its personnel. Upon being ordered to areas of greatly increased danger of infection, reimmunization was required prior to leaving the United States. Because of the high incidence of smallpox in the civilian population of India, the Theater in 1942 adopted the policy of revaccination of all personnel upon arrival and once each three years thereafter.³ The first mass reimmunization of personnel was performed in October 1942.⁴ The Theater policy on the frequency of revaccination was soon changed and was placed on record by a circular published in August 1943 in which smallpox revaccination at intervals of every six months was required.⁵

Supplies of smallpox vaccine were received from the United States on automatic issue until January 1944. This vaccine was carried by water, was refrigerated enroute, and took from 45 to 60 days to reach the Theater. Distribution within the Theater was made by iced thermos jug.

Considerable doubt existed in the minds of Theater medical officers as to the potency of United States vaccine. Not only was it at least three months old by the time it could be used, but one could never be certain that refrigeration had been continuous. Also, within the Theater the feeling had grown that smallpox in India was caused by a different and more virulent strain than the same disease in the United States. The reported higher smallpox fatality rates among civilians in India augmented the feeling. Other factors which might contribute to this higher fatality were hard to evaluate. Many medical officers, therefore, preferred to use locally procured smallpox vaccine of Indian manufacture. This vaccine was procured from various laboratories located in different parts of India and no particular attempt seems to have been made to insure proper refrigeration during storage and shipment.

The occurrence in 1944 of smallpox among Chinese troops from which several cases developed among U.S. troops again raised the question of the effectiveness of the vaccine being used⁶ and of the correct reading of the reactions.⁷ All cases were reported by radio to the Theater Surgeon upon diagnosis and a letter report of each case was required. Review of immunization records revealed that an entry of "Immune" was frequently made where the patients concerned were very evidently susceptible. It could only be concluded that, as given, the vaccinations did not protect these individuals. The importance of careful vaccinations and correct reading of reactions was emphasized by a Theater Circular dated 1 April 1944.⁸ It

seemed possible that vaccination of inductees in the ZI had become such a routine procedure that professional standards lapsed.⁹ In this Theater some medical officers undoubtedly entered "Immune" on the register of vaccinated individuals on whom a vaccination scar was visible. Sufficient time was not taken to "read" the vaccination at the proper intervals to determine whether the reaction, if any, was immune, vaccinoid or vaccinia. Careful reading would have indicated faulty technique or non-viable vaccine if too great a number of "no-takes" occurred. As it was, a successful vaccination of everyone at even three-year intervals may have afforded greater protection than the machine-like repetition of the vaccination procedure at 6-month intervals in the hope that the multiple vaccinations would take care of those left unprotected previously.

The high incidence of smallpox in CBI American troops was referred to in the report of the Kelser Mission in November 1944.¹⁰ Immediately thereafter the entire problem was reviewed by the Preventive Medicine Division. The decision was made to concentrate on three critical factors, namely, securing a known potent vaccine, proper refrigeration of the vaccine during storage and transfer and finally the elimination of carelessness in performing, reading and recording the results of vaccination. A vigorous campaign of education to acquaint medical officers of the methods necessary to control smallpox was started using the Surgeon's Field Medical Bulletin followed up by field inspections to see that orders were carried out.¹¹ Revaccination annually was prescribed in January 1945.¹²

In conformity with War Department policy of utilizing American made immunizing agents except for smallpox vaccine, anti-rabies vaccine and snake antivenom serum, arrangements were made with the King Institute, Madras, to supply all the needs of IBT and automatic shipment of vaccine from the States was discontinued in January 1945.¹³

This action encountered considerable hostility in the field. Many medical officers were dismayed at the prompt and severe vaccinia reaction encountered after the use of potent Indian vaccine. This led to a series of investigations by the 9th Medical Laboratory which indicated that King Institute lymph contained a viable hemolytic streptococci and frequently showed bacterial counts in excess of that allowed by the regulations of the British Therapeutic Substances Act. A visit of inspection to the laboratories of the King Institute by the Theater Epidemiologist and the Commanding Officer, 9th Medical Laboratory, disclosed that manufacturing techniques were not up to the full standards prescribed by the B.T.S.A. or the Biologic Control Division of the U.S.P.H.S.

In spite of these objections, King Institute vaccine was used for the April 1945 vaccination program since it was the Surgeon's

opinion that a live vaccine was more important than a bacterially sterile product whose specific potency as a vaccine was unknown.¹⁴ However, due to prejudice against the Indian vaccine and the fact that a refrigerated box suitable for air shipment of vaccine has been developed by the War Department the use of American products was reinstated in early summer of 1945.

Air travel from the U. S. being regular, a request was made for a trial shipment of vaccine by air, refrigerated with dry ice.¹⁵ The first shipment was made in March 1945¹⁵ and was received in excellent condition.^{17, 18} Since that date, supplies of fresh potent U.S. vaccine have been maintained in the Theater.¹⁹ The shipping containers consisted of an insulated box with double cover, within which a can of dry ice was suspended in a wire framework. The packages of vaccine were placed in the wire framework adjacent to the can of dry ice. The shipping container was checked by weighing at two points enroute to determine whether re-icing was necessary. Freezing temperatures were maintained for 200 hours with a single charge, which was usually sufficient for the entire trip. (See illustrations).

In the spring of 1945 an interesting problem in differential diagnosis arose in the Theater when four cases of generalized vaccinia were reported from one hospital within a month's time.²⁰ One of these patients died. An epidemiological investigation of these cases showed that they all had been exposed upon arrival in the Theater and were not vaccinated until a week or more after exposure, and about a week before the rash appeared.²¹ The final diagnosis was established as smallpox, the vaccination in these four instances not being performed in time to provide immunity.

CONTAINER USED FOR SHIPMENT
OF SMALLPOX VACCINE

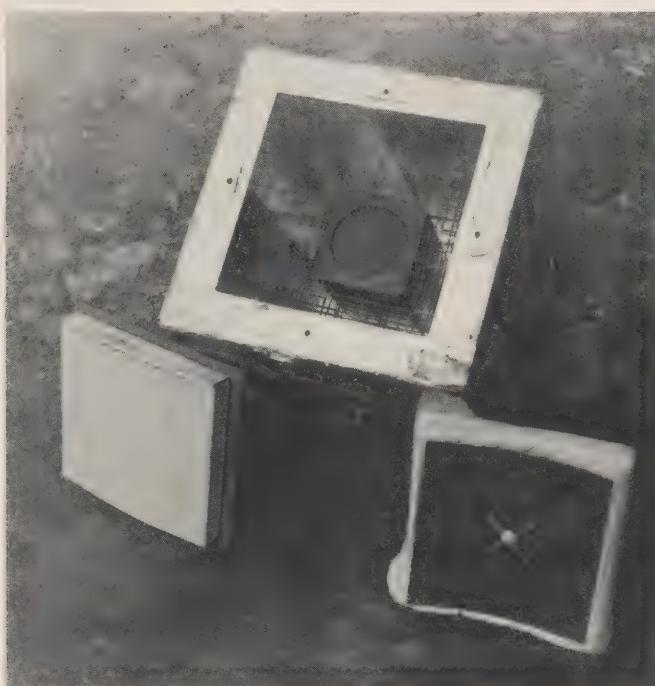


CHART I
SMALLPOX
CASES

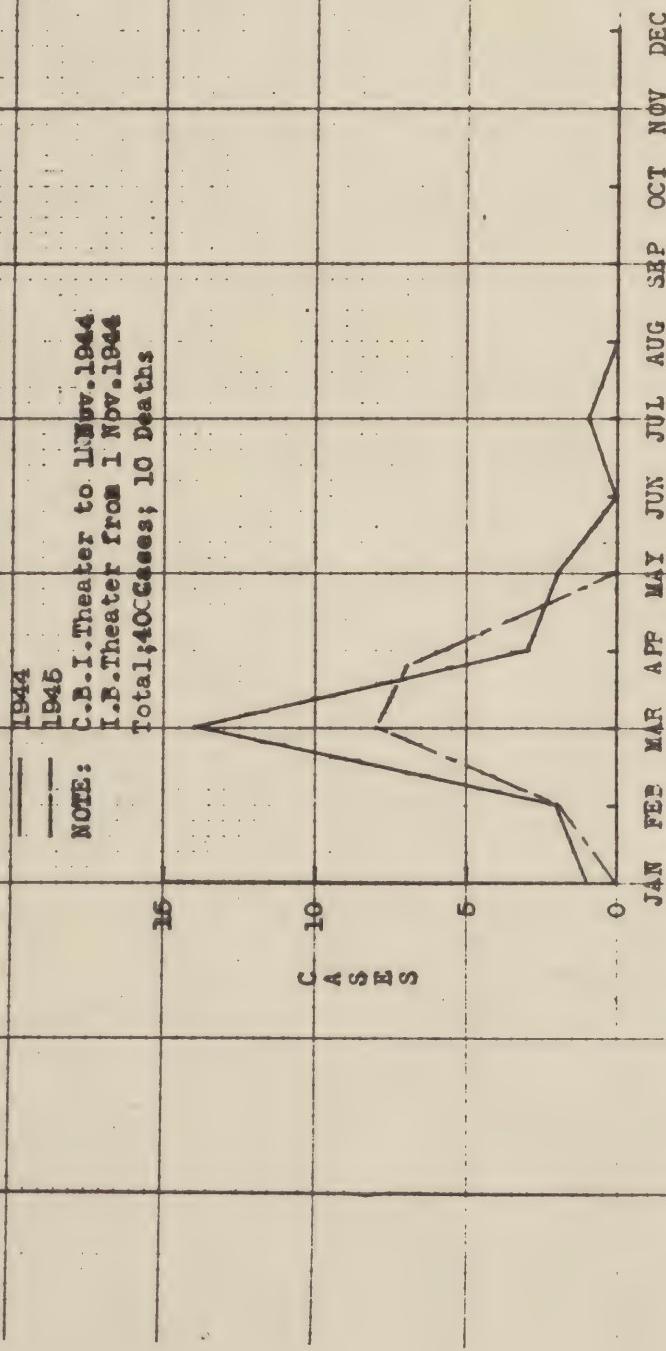


TABLE III

SMALLPOX

Rate per 1000 per Year

U. S. Army Personnel

Month	1944		1945	
	Cases	Rate	Cases	Rate
January	1	0.13	-	-
February	2	0.24	2	0.13
March	14	1.17	8	0.40
April	3	0.30	7	0.43
May	2	0.17	-	-
June	-	-	-	-
July	1	0.08	-	-
August	-	-	-	-
September	-	-	-	-
October	-	-	-	-
November	-	-	-	-
December	-	-	-	-

Note: There were no cases in 1942 or 1943.

There were 6 deaths in 1944 and 4 deaths in 1945.

1944 CBI: 1945 IBT.

3. Typhoid, Cholera, Typhus, Plague and Tetanus

There is little to report concerning CBI experience with these vaccines. One interesting fact appears from the records. At one time or other there was a feeling among medical officers that vaccines produced from local Indian or Chinese strains were more potent and gave better protection against the local diseases than did the refined American made products. A Theater directive was published 26 December 1942 requiring a stimulating dose of Indian made typhoid vaccine²² but this seems to have been rescinded a few months later following an exchange of correspondence between the Theater Surgeon and The Surgeon General's Office.

Many medical officers insisted upon using Indian made cholera and typhoid vaccines whenever they were available and it was not until early 1945 that a general agreement was reached to purchase and issue only the following types of locally produced immunizing agents: anti-rabic vaccine, anti-snake venom serum and smallpox "lymph". As pointed out elsewhere, the latter product was dropped when air shipping facilities for preservation of smallpox vaccine enroute from the ZI were perfected.

Plague vaccine was used on a large scale only in one instance. In June 1945 an epidemic of plague threatened to creep out of the Taping Valley in West China and endanger the traffic along the Stilwell Highway. Some 8000 to 10000 troops stationed in the vicinity of Bhamo were therefore vaccinated with American plague vaccine. The injections were well tolerated and gave rise to no unusually severe reactions. The general opinion among observers was that the reactions were less severe than following typhoid vaccination. Haffkine Institute plague vaccine was used by the 84th Air Depot Group at APO 491 for the immunization of 320 men. This seems to be the only instance where Indian type vaccine was used. A report of the reaction noted was made to the Theater Surgeon.²³

The experience with tetanus toxoid was similar to that in other theaters of war. It was used only for stimulating the immunity of the wounded and burned. No difficulties were reported. One case of tetanus occurred in American troops; this was reported from the 100th Station Hospital in Delhi.²⁴

The Theater Surgeon on 6 March 1943 requested the British military authorities to administer tetanus toxoid rather than tetanus antitoxin to all wounded American troops coming under British medical care but this seems to have run into supply difficulties at G.H.Q.(I).²⁵

4. Influenza

All military personnel in India-Burma Theater were given a single 1 cc. dose of influenza virus vaccine, types A and B, between 1 October and 30 November 1945, as prescribed by W.D. Circular No. 267, 5 September 1945. The program of immunization was laid down in a Theater Headquarters Circular,²⁶ 26 September, amplified by Surgeon's Circular No. 24, same date,²⁷ and by Surgeon's Memorandum, subject: "Influenza Vaccination," 7 November 1945.²⁸

This program was carried out during the process of evacuating the Theater and more than half the personnel were immunized while passing through replacement depots at Karachi and Calcutta. In order to avoid wasteful dispersion of material, vaccinations were limited to these stations during the period 1 October to 15 November. At least 100,000 doses were given in these staging areas. The remaining personnel were vaccinated at their home stations during the last half of November.

Reports of reactions were unreliable due to the fact that the majority of personnel were loath to report back for treatment due to fear of losing their place in the evacuation scheme. This is shown by two monthly reports from the replacement depots.^{29, 30} One depot reported 0.2% reactions in a group of 26,631 persons. The other depot reported 0.1%. Only 21 hospital admissions were reported in 57,000 vaccinations.

In Delhi, among staff officers, at least 50% complained of mild to moderate malaise, chilly feeling, aching and "grippy" sensations lasting for 24-48 hours. There was some evidence that colds and sinusitis were exacerbated by the injections.

From the experience in India-Burma Theater the conclusion was drawn that the present influenza vaccine is well tolerated and can be administered safely to large population groups.

5. Yellow Fever

Problems concerning yellow fever immunization in the India-Burma Theater were, throughout the war, bound up with the complex situation created by overwhelming fear on the part of the Government of India that yellow fever might be introduced from Africa by military air travel. Whether or not this anxiety is justified by present conditions is a moot question. The fact remains that the fear of yellow fever is real among Indian and British public health officials and acts as a paralysing influence on any proposal to facilitate air travel into India from the west.

Since an important part of the American war effort in India was tied up with ATC air traffic from the west, the problems of quarantine, immunization and disinsectization of planes had an important place in preventive medicine activities in India-Burma Theater. Fortunately, liaison between the Surgeon's Office and the responsible officials in the Government of India was facilitated by juxtaposition. Personal conferences were frequent and telephone conversations were often possible in spite of the weird and unbelievable difficulties imposed by language handicaps and the barrier of "babu officialism."

The history of our relations with the Government of India, so far as yellow fever is concerned, is tied up with the attempt to reach a compromise between the American and the Indian viewpoints on quarantine. Reduced to its simplest terms the Americans desired Indian acceptance of the following principles: (a) yellow fever immunity is established 10 days post-vaccination, (b) the incubation period of yellow fever is that agreed upon by international conventions, namely 6 days, and (c) disinsectization of planes by the techniques used by our Air Forces is adequate for the elimination of all yellow fever insect vectors. Opposed to this was the Indian fear of the atypical case of fever, the unidentified carrier of virus, the carelessness of flight crews in the matter of disinsectization and falsification of immunization registers. Because of these considerations, the scientific advisors to the Government of India adopted a very conservative attitude towards easing the official quarantine and immunization requirements.³¹

Unfortunately there were repeated incidents tending to strengthen belief in the fallibility of air crews. Planes overflowed the quarantine station at Karachi not infrequently and the security precautions surrounding the entry and routes of the long range bombers gave rise to a certain amount of suspicion as to their compliance with the sanitary code.

The abandonment of the Central Africa ATC air routes in the early summer of 1945 eliminated the major portion of these difficulties and permitted the abolition of yellow fever immunization of west-bound passengers.³² There remained, then, only the problem of eliminating compulsory vaccination of India-bound personnel passing through Europe and North Africa (non-endemic areas). The sole obstacle to this was the fact that the Government of India was not yet willing to agree that a susceptible person would not be contaminated by travel from Egypt in a plane that had been exposed to infection by recent passage through the endemic yellow fever area of Africa. This was one of the knottiest problems discussed at the 7th meeting of the India Yellow Fever Committee at Simla on 10 July 1945.³³ The committee, speaking as a group of scientists, were willing to admit that the problem was more or less academic since American disinsectization practice was such as to practically insure that passengers aboard such planes could not be infected by mosquitoes from the danger zone. However, they

were unable to commit the Government of India to a written agreement in this matter and the Surgeon was finally driven to informing War Department that no categorical assurance of immunity to quarantine would be given to non-vaccinated persons arriving in India on an "infected plane".

The problems of quarantine and yellow fever immunization in India are treated at length in the reports of the Army Quarantine Liaison Officer, on file in The Surgeon General's Office.

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1. Narrative Review of Malaria Control in IBT

Malaria was the India-Burma Theater's number one disease problem. It was present everywhere and was especially severe in the very areas where our troops had to work.

The objectives of the Theater were to drive the Japs out of North Burma, to construct the Stilwell Road from Ledo, India, and to transport supplies into China. The focal point of this entire project was in Assam, India, and Northern Burma, normally one of the most malarious areas in the world. In 1942 it was even worse than normal. Thousands of refugees had been pushed out of Burma into this hyperendemic area, the quinine supply was inadequate¹ or non-existent, vector mosquitoes were everywhere, health and sanitation were at a low ebb, and the disease flourished. Into this area it was necessary to send American and Chinese combat men; the American engineers to construct the road, the pipe line, and the communications; the air corps units to fight and transport supplies, and the trucking outfits to haul supplies.

The situation along the line of communications from Calcutta and Karachi was almost as bad. The flat river valleys of the Brahmaputra, the man-made breeding areas along the railways, and the port cities had always been notoriously malarious areas. Our mission was such that we could not avoid these areas; we had to work in and travel through them.

In the face of these conditions the British predicted that during the summer months 30 to 35% of our command would be in the hospitals at all times.² Colonel J. M. Tamraz, the first S.O.S. Surgeon, after a reconnaissance of the forward area, entered in his diary:³

"My impression of the country, having been made in the so-called dry season has made me to come to the conclusion that it will be next to impossible to continue operations in this country after April 15th when the monsoon season begins here in earnest. Even now with only occasional rains it looks formidable. The country is honey combed with streams and lagoons which are ideal breeding places for mosquitoes. I believe the sick rate among the Chinese troops will run into 50% to 75% and among the American troops to 20% or more. As for the coolie labor, they are probably all chronically infected. The native labor will in all probability, desert the work, while the Chinese troops will be too much

malaria infected for either construction or combat".

Early experience indicated that these figures were just about right. One organization travelled across India to a destination in Assam. Thirty-five per cent of the command was hospitalized⁴ with malaria during the first month the organization was in the Theater. The 20th General Hospital at Ledo reported⁵ in September 1943 that 73% of its patients were malaria cases. The incidence in the civilian population throughout India was reported as 100,000,000 to 200,000,000 cases per year with 1,000,000 to 1,500,000 deaths.⁶

The Japanese also had considerable trouble with malaria. A number of POW's, including several medical corps men, were interrogated on 16 and 17 August 1944, by Major M. Seltzer, Malariaologist Base Section No. 3, through an interpreter. He obtained the following information:⁷

Incidence was: "8 out of every 10 men had it". "We all had malaria at once". "90% had it". "3 out of every 10 men were sick with malaria at all times". "Some men had it 8 to 15 times, but many had it 3 to 4 times".

It was Major Seltzer's opinion that these Jap soldiers were well aware of the disease. They could describe it perfectly. The large numbers of Japanese head nets, mosquito gloves, and repellents found on the battle fields would indicate their recognition of the problem and attempt to do something about it.

Soon after the formation of the China-Burma-India Theater in March 1942, and the appointment of Theater and S.O.S. Surgeons, malaria control work was started. In April 1942 the officers of the U.S.P.H.S., then detailed as the Medical Commission to the Burma-Yunnan Railway, having been driven out of Burma by the Jap invasion, were ordered to report to the Theater Commander for duty.⁸ Most of these officers were assigned to the Surgeon, S.O.S., for duty. The senior officer, Lt. Colonel Victor Haas, was retained in Delhi while others were sent to Karachi, Agra, Allahabad, Ramgarh, and Chabua to initiate malaria control in the field. The only anti-malaria supplies and equipment available⁹ were some that had been shipped to the Burma Yunnan Railway but were diverted to Indian ports because of the capture of Rangoon. They consisted of a small number of sprayers, a few tons of Paris green, and some pyrethrum extract. The only work possible during the first season was permanent control measures around the mushrooming bases and air fields. The malaria rate was high.

Perhaps it was fortunate that the first year's rate was not good. It pointed out that strong preventive measures must be initiated. A malarialogist and several of the newly organized and trained

malaria units were requisitioned from the Zone of Interior.¹⁰ Lt. Colonel Earle M. Rice, MC, was appointed Malariaologist and the first of the anti-malaria units arrived from the States. Supplies also began to arrive, and during 1943 malaria control got under way. There were no immediate startling results. However, a program was started which eventually toppled malaria from its number one position to an insignificant level.

The problems of those days were not usually technical questions regarding mosquitoes, or drainage, or how to handle an area, but rather they involved such things as authority and responsibility, (SOS and AAF) civil population around bases and fields, labor, supplies, command responsibility for individual protection, education of troops, areas to be protected adjacent to bases and airfields, lack of technical personnel and anti-malaria supplies, and relations with allied armies. Decisions were made and the program went ahead.

By midsummer 1944 malaria control presented a vastly different picture than it had in 1942 when there was a mere handful of U.S.P.H.S. officers working without equipment or supplies; or in 1943 when there were two survey and two control units just starting to work. Now there were 4 survey and 15 control units, there were a Theater Malariaologist and Section Malariaologists, there was repellent in abundance, pyrethrum spray, aerosol dispensers, hessian cloth, mosquito netting, sprayers, malariol, and rumors of DDT.

The anti-malaria units were deployed¹¹ from the ports of debarkation at Calcutta and Karachi to the most forward point in the Theater (the Jap-surrounded Myitkyina airstrip). They were protecting the long lines of communication, the newly constructed B-29 Bases, the old "Hump" bases, the advance depots at Ledo and Shingbwiyang, the engineering outfits carving out the Ledo Road, and the combat bases at Shaduzup, Mogaung, and Myitkyina. They were using thousands of coolie laborers digging ditches, cleaning out tanks, and larviciding breeding areas. They were putting up roadside signs warning of the dangers of malaria, they were supervising mosquito-proofing projects, distributing mosquito repellent at outdoor theaters, and trucking supplies into the forward areas. The survey men were out locating breeding areas, making blood and spleen surveys, and working in their laboratories. In the latter part of the season there was some DDT, and experiments with its use, both from the ground and the air, were started. There was constant educational program in progress utilizing radio, movies, GI newspapers, signs, posters, and personal contact. There was a degree of protection for every one, much more than in previous years, but still not all that was desired. More personnel, more equipment, more supplies, and more DDT were ordered for the next year.

In 1945 all of the above measures were intensified. Several additional anti-malaria units arrived and were put to work. A new Theater directive was published 31 January 1945 which simplified and stressed command responsibility, initiated air spraying with DDT on a large scale, facilitated the distribution of anti-malaria supplies including adequate amounts of DDT, and initiated blanket atabrine suppressive treatment in forward areas.

The results of this revitalized program were very satisfactory. The usual seasonal rise of malaria rates failed to materialize, but instead the rates declined to the extremely low figure of 15-20/1000/ annum and remained at this level throughout the rest of the life of the Theater. The Burma campaign ended in March and the Stilwell Road was completed a short time later permitting a great majority of our troops to resume a quiet garrison life in areas where mosquitoes were almost unknown due to the efforts of the malaria control and survey units.

The degree of control finally obtained over malaria in IBT was greater than ever anticipated by the most optimistic prophet. The major share of the credit for this achievement must be given to the anti-malaria units who tackled a seemingly hopeless job in 1943 and with untiring energy and dogged persistence carried the fight to a successful conclusion.

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Tall grass was among one of the terrain features which made malaria control difficult in Burma



ANTI-MALARIA SIGNS REPLACED THE FAMILIAR
"BURMA SHAVE" SIGNS ALONG THE STILWELL ROAD!



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2. Education and Training

The early days of the Theater were characterized by shortages in everything, even shortages in education. The troops that arrived here in 1942 and 1943 knew very little about malaria or how to protect themselves. An education program was started in 1942 and has been continued through to the closing of the Theater.^{1,2}

Serious education of the troops was initiated following the publication of War Department Circular No. 223, which required that all personnel in the Army undergo an intensive 4 hour course in malaria and its prevention. This course was given in the States, but for those troops who were in the Theater prior to issuance of the directive, it was given here in the field.³

Education of incoming troops started on the boat at the Port of Debarkation. Personnel were given an anti-malaria lecture, were reminded that they were now entering one of the most malarious areas in the world, and told how to protect themselves. Special emphasis was placed on the immediate problem - ^{4,5} protecting themselves while enroute across India. Anti-malaria measures were explained and demonstrated.

The constant and Theater-wide educational program carried on by the entire Theater anti-malaria organization was intended to supplement the initial training course by constantly reminding the individuals of the dangers of malaria and what they could do to protect themselves. Greatest emphasis was placed on the importance of repellent, protective clothing, bed nets, sprays, and atabrine. The troops were reminded repeatedly that they had all the instruments of protection, it was just up to them, as individuals, to utilize them.

The educational media most frequently employed were:

- a. GI movies. Rarely did a person see a movie without paying for his admission with a liberal application of repellent, and then seeing an anti-malaria movie short.

b. Radio. GI radio stations broadcast short, catchy, anti-malaria skits several times daily.⁶

c. Roadside signs. There are anti-malaria roadside signs from the ports of debarkation to the gates of Kunming. They are varied, original, interesting, and instructive.

d. Posters. Bright, attractive posters were supplied for exhibition in day rooms, bulletin boards, mess halls, and orderly rooms.

e. Army news sheets. The local newspapers frequently carried anti-malaria news and warnings.

In 1944 and 1945 the troops in this Theater had a satisfactory working knowledge of malaria - 7 and they were never allowed to forget it.

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POSTERS AND SIGNS WERE USED THROUGHOUT THE THEATER
FOR ANTI-MALARIA EDUCATION





Instruction in Malaria Control at 2nd Convalescent Camp
(reconditioning program)



Anti-malaria warnings were broadcast daily during the malaria season on Army radio programs in India

and preventive practices related to malaria among two groups of soldiers in CBI."

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3. Personal Protective Measures^{1,2}

Personal protective measures were used throughout the Theater wherever and whenever they were necessary. The need for personal protection varied somewhat with the seasons but primarily with the location of the individual, and depended on whether or not he was living within a controlled zone. Those in combat, those in scattered and isolated detachments, and those in transit had to depend entirely on their own efforts for malaria protection.

The various items given the individual soldiers were adequate to provide complete protection. However, they were not popular and too frequently were used only to avoid disciplinary punishment. The benefits of repellent were known to every soldier in the Theater, but he still did not like repellent and did not use it voluntarily. It had to be forced on him at formations, outdoor theaters, etc. Enforcement, except at formations, was next to impossible.

Long sleeved shirts and trousers, high shoes, and tucked-in shirts on a hot, humid, monsoon evening were just as unpopular and just as unpleasant as the repellent. The protective clothing regulation was easy to enforce by an inspecting officer because it was self evident.

Bed nets were uniformly accepted and used without complaint. The early nets were made of a loosely twisted thread, were quite impervious to air movements, mildewed easily, and consequently were hot, smelly, and undesirable. Later types, especially those made of nylon, were a far better and more acceptable product. Bed nets also protected the sleeper from the thousands of other jungle insects, as well as rats, leeches, scorpions, and spiders.

Mosquito head nets and gloves were seldom, if ever, used; they were uncomfortable and decreased the efficiency of the wearer. As much as the average soldier disliked repellent, he would still use it rather than head nets and gloves.

The jungle hammock provided a very satisfactory mosquito-proof bed for personnel who could not carry the conventional cot and bed nets. It was used extensively in the forward sectors. Two changes in design could be made to render it more universally acceptable. The zipper closing proved to be unsatisfactory under combat conditions. It was too noisy and complicated. The zippered side was frequently left hanging

down, unzipped, so that the occupant could get out quietly and quickly. The method of closing could be changed to suit battle conditions. Also, there is no place to put clothing during the night. This could easily be provided by having an opening in the double bottom to provide a dry, clean storage space.

Spraying with pyrethrum extract was universally done. Both aerosol dispensers and hand sprays were used with equal satisfaction; some preferred one method, some the other. In general the hand sprayers seemed to be better suited to large rooms (mess halls and day rooms) and the aerosol dispensers to small rooms, tents, and bed nets.

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REFERENCES

1. Report by Research Unit, Special Service Section, Hq USAF CBI, 14 October 1944, "Malaria, a study of the attitudes, knowledge, and preventive practices related to malaria among two groups of soldiers in CBI."
2. From personal experience of the author, Major S. J. Weidenkopf, SnC, as a Malaria Control Officer in Burma and Assam from June 1944 to October 1945.

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4. Organizational Anti-Malaria Detail

Under the authority of WD Circular 223, 21 September 1943, and IBT Circular 11, 31 January 1945, anti-malaria details were formed in all companies and similar organizations. They performed simple anti-mosquito measures. These measures frequently were in the form of repairs to mosquito proofing, ditching and larviciding. Quite frequently they performed the highly beneficial function of residual spraying (with 5% DDT) of the tents, billets, mess hall, and other buildings of their organization. This duty was undertaken after preliminary training with a malaria control detachment or under the supervision of the Battalion Surgeon.

MALARIA CONTROL WAS DIFFICULT FOR ISOLATED
DETACHMENTS



Photograph shows elephant ear and floating
grass in tank before control
measures began.

5. Malaria Control and Survey Detachments

Among the early Medical Department organizations to reach the India-Burma Theater were the Army's new Malaria Control and Malaria Survey Units. They arrived in the spring of 1943,¹ during the early expansion period of the Theater, and took over the job of malaria control already started by the U.S.P.H.S. officers assigned to the Theater. The key personnel of these units were flown over from the United States; the remaining personnel and equipment came by water.²

The original group consisted of six units, three survey and three control. One of each type was sent on over the "Hump" to China; the remaining four (7th and 9th Survey, and 17th and 18th Control Units) were spread out from Calcutta to Chabua to care for the long line of communications, the bases, air fields, depots, and concentrations of troops being built up in that wide area. The organization was stretched "to the breaking point,"³ supplies were meager, and equipment was scarce.

The officer personnel of these first units included:⁴

7th Malaria Survey Unit - Lt. John Wilson - Entomologist
Capt. O. F. Gursh - Parasitologist

9th Malaria Survey Unit - Lt. Robert Traub - Entomologist
Lt. E. O. Wicks - Parasitologist

17th Malaria Control Unit - Lt. J. L. Dallas - Malaria Engineer
18th Malaria Control Unit - Lt. M. L. Crowder - " "

These early units were so effective that more and more were ordered until the organization had grown from four in 1943 to 38 in 1945, and they were deployed the length and breadth of the Theater.

The anti-malaria units used in this Theater were the standard units of T/O & E 8-500, columns FA and FB. Most of the units were activated, trained, and equipped in the Zone of Interior and then shipped to this Theater. However, four units (the 43rd, 44th, 45th, and 46th Malaria Control Units) were activated in IBT,⁵ and staffed with personnel from other Medical Department units.

Malaria Control and Survey Units were entirely new organizations within the Army and suffered all the growing pains of repeated changes in T/O & E, reorganization and redesignations. During 1943 all the units were "Theater Troops" and functioned under the direction of the Theater Malariaologist. In April 1944 the units were divided; those in the forward areas were assigned to N.C.A.C.,⁶ and the remainder to S.O.S. The units assigned to S.O.S. were then further assigned to the various S.O.S. Sections. Regardless of assignment, the units served all American troops within their area of operation.

The results obtained by these units were truly phenomenal, although it was two years before the full effects could be felt. In 1945, which saw a great drop in malaria incidence,⁷ control and survey programs begun by the anti-malaria units in 1943 reached their maximum development and passed into the maintenance phase. At the same time, civilian labor resources, anti-malaria equipment, and supplies of all types became entirely adequate for the first time; DDT, dispersed from the ground and from the air, became plentiful. For the first time, also, it was possible to extend the controlled areas to include almost all concentrations of troops because neither combat nor road and other construction projects took troops into undeveloped regions of India and Burma. In contrast, the reservoir of native infection was still present and malaria raged with its usual fury outside the controlled zones. The difference was that there were no mosquitoes within the controlled zones.

The survey units routinely reported the complete absence of vector mosquitoes and that their laboratory specimens had to be obtained from outside the control zones. The June 1945 report of the 35th Malaria Survey Unit⁸ was typical; it reported of the Ledo, Assam, area: "The monsoon season is well underway and the breeding outside the control zone is approaching a maximum. Vector species, either adults or larva, were rarely found within the control zone." Its summary of the Shingbwiyang, Burma, area was: "A total of thirty-five hours was spent in morning and evening adult collections. The results were disappointing as only three A. Maculatus could be found within the control area and they were all negative."

Newly arrived personnel at an Assam or Burma base were frequently heard to remark:⁹ "I thought I was coming to a highly malarious area, and I haven't even heard a mosquito in the 45 days I've been here." "I wish that the home-town was this free of mosquitoes." "Why do we have to use repellent? There aren't any mosquitoes here." "I haven't seen one since I've been here." These persons had not been outside the controlled areas, nor had they seen the vast numbers of malaria cases in the civil hospitals.

Unfortunately it was not possible for the anti-malaria units to provide this excellent protection for all American troops. There were the isolated detachments, the scattered units up and down the Ledo Road, the transients and the combat troops. They were dependent on personal protective measures. However, as combat ended and the Theater became stabilized an increasingly greater percentage of the population was able to enjoy the benefits of these protected, malaria-free zones.

MALARIA CONTROL HEADQUARTERS AT ADVANCED
BASES IN ASSAM, INDIA & BURMA



DRAINAGE OF ANOPHELENE BREEDING AREAS
ASSAM, INDIA



81-44-24726

Malaria Control Detachments

During the early days, the methods of control were dictated by the means available. As there was plenty of native labor and there was oil for larvicing, the programs were mainly draining and larvicing projects. As supplies began to get through, a more elaborate program evolved.¹⁰ It was:

a. Drainage. Whenever possible all breeding areas were drained. Thousands of miles of ditches were installed and thousands of acres of breeding areas were thereby eliminated. The monsoon rains did not accumulate puddles and swamps but ran off through these self-flushing ditches.

b. Larvicing. There were many places in the control zones where larvicing was the appropriate method of control. There were rice paddies that could not be drained because of their essential food crops. There were low, flat areas which could not be drained satisfactorily, there were water tanks essential to the life of the villagers, and there were areas where only temporary control was needed. The standard larvicides were malariol and paris green dust.

c. Mosquito proofing of living quarters. A great deal of protection and comfort was given the troops by mosquito proofing tents, bashas, mess halls, and day rooms. Hessian cloth (a coarse gummy sack material) and mosquito netting were the materials used. During the early days the entire supply was of British manufacture and very scarce. During 1944 and 1945 large amounts of American made netting arrived to supplement the British stocks. However, it was not until midsummer of 1945 that sufficient quantities could be moved into the forward areas in Burma to meet the demand.

The malaria control units distributed the mosquito-proofing supplies, supervised installation, and checked maintenance. Without this skilled and enthusiastic assistance adequate mosquito-proofing would never have been accomplished.

d. DDT in the malaria control program. Experimental quantities of DDT began arriving¹¹ in 1944 and were put to immediate use.¹² The results of the tests indicated that DDT was almost as effective as the forecasts had predicted and much better than any other single agent then available. Volumne shipments began to arrive in the latter part of 1944 and continued throughout 1945.

The entire mosquito control program was altered¹³ to take full advantage of this new insecticide. It revolutionized the fight against the mosquito almost as completely as the atomic bomb did the fight against the Japs, and with equally good results. It extended and enhanced an already effective program. It made the previous oiling and dusting work more potent. It made a little material go a long way, and it could be used in the essential rice paddies and water tanks that could not be treated with large amounts

of oil. Most important of all, it was a potent weapon against adult mosquitoes. It was a trap that would stay set for weeks and kill every mosquito that touched it, a trap that could be set easily, and could be used for large areas or small. It was a weapon that could be used quickly to reduce the large adult populations of newly captured areas.

During 1945 DDT was used extensively in the following ways:

(1) DDT residual spray. This was the top priority project of all mosquito control work. It consisted of spraying all native dwellings (within the control zone) with a 5% DDT-kerosene solution. In this Theater it was not possible to move the reservoir of malaria (the native peoples) away from troop concentrations. However, spraying of native habitations killed the mosquitoes at the point where they became infected and stopped transmission of malaria to American troops. Many other disease-bearing insects and pests were killed at the same time, resulting in a generally healthier group of people to work with and live near.

The usual method of application was by an engine driven paint sprayer. However, a hand operated decontaminating or knapsack type sprayer could be used with equally good results.

Native peoples were naturally sceptical the first time they were confronted by a team of sprayers. Every effort was made to explain and sell the program; the most effective way was to have a native doctor or other respected citizen go ahead of the spraying crew and explain to the people what was being done. The results of the first spraying made converts out of the most sceptical. The only trouble thereafter was when a sprayer might miss a small spot; the resident would usually notice it and insist that he come back and complete his job.

All American installations were sprayed, either by teams from the malaria control detachments, or by the anti-malaria details of the organization. Frequently the battalion surgeon would organize a DDT spraying detail, have it trained by the malaria control detachment in the vicinity, and then periodically route it through the battalion, spraying all tents, billets, latrines, mess halls, and day rooms. Small isolated detachments used DDT effectively to decrease their mosquito populations. All breeding areas and natural resting places within and about the tents were sprayed, thus creating an oasis for humans and a death trap for mosquitoes.

Combat troops used DDT to spray their foxholes, dugouts, fortifications, and similar mosquito haunts. Forward command posts were frequently located in native villages. A thorough spraying of all billets and occupied areas quickly reduced the adult mosquito population and provided a great deal of protection and comfort.

Soldiers travelling across India were given added protection and comfort by DDT. In 1945 all troop trains leaving Assam were thoroughly sprayed prior to departure.

LARVICIDING WITH OIL AND DUST IN BURMA
AND (BELOW) ASSAM



SPRAYING NATIVE AREAS WITH DDT RESIDUAL SPRAY



MOSQUITO PROOFING PLUS DDT GAVE EXCELLENT PROTECTION



Spraying Tent Quarters



Mosquito proofing a bamboo "basha" with hessian cloth

IN 1945, TROOP TRAINS WERE THOROUGHLY SPRAYED
WITH DDT BEFORE DEPARTURE



(2) Larviciding. All breeding areas within $\frac{1}{2}$ mile of Army installations were larviced. In the pre-DDT days the job was done with oil and paris green; now DDT made the job simpler and more effective. It was found that small amounts of DDT dissolved in standard malaric oil greatly increased the killing power of the oil. An equal amount of solution could now be spread over a much larger area. This was especially important in the many "hard to get into" and forward areas where transportation of supplies was always a difficult and important problem.

Airplanes were found to be effective dispensers of DDT solutions. Experimental work was started in the summer of 1944 and routine spraying done throughout 1945. It was found that this tool was useful in controlling large, flat, inaccessible, swampy areas and in quickly controlling the newly captured areas. Effectiveness was definitely limited by the rough, mountainous terrain of Burma which kept the planes high, the dense jungle canopy, and the monsoon weather which frequently prevented routine operations or washed away the larvicide immediately after it was dispersed. DDT dusting powder was found to be superior to the old paris green. It was used extensively to control breeding in rice paddies.

Malaria Survey Detachments

The functions of the malaria survey detachments were to make entomological and parasitical investigations, surveys and reports, to locate the danger areas, and to check on the effectiveness of the anti-malaria programs. In this Theater it was not difficult to locate the reservoirs of infection; it was everywhere. The only question was of degree; some areas were found to be worse than others.

The survey units performed their greatest service in working with the vector species, first isolating and identifying them, and then pointing out their breeding areas to the control crews. They also played a vital part in the many DDT experiments, determining the effectiveness of the methods of dispensing the various solutions, emulsions, and mixtures.

In addition to the routine investigations and period reporting, several special studies were made and reported. Notable among these was the report, "Observations on Anopheles Leucosphyrus Don," by Louis C. Kuitert, Captain, SnC, USA, and John D. Hitchcock, Staff Sergeant, Medical Department, USA.¹⁴ This report summarized the information which the authors had been collecting in the field in North Burma and Assam. It indicated that this mosquito was probably a far more important vector (in this particular area) than had previously been recognized. The report was forwarded to Washington for publication.

The special DDT experiments started with the receipt of the first shipment of powder and continued through to the closing of the Theater. Many of these experiments were of local interest and informally done. Others were of general interest, were carefully planned and executed, and reported.

Typical of this latter group were:

a. "Report on Aeroplane Spraying of DDT at Deamalie Tea Garden,"¹⁵ by Capt. John Wilson, Commanding Officer, 7th Malaria Survey Unit. This paper reported the first airplane spraying in the Theater.

b. "DDT Experimental Results at Mars,"¹⁶ by Capt. Louis C. Kuitert, reported the results obtained by DDT airspraying at the Mars Task Force camp north of Myitkyina, Burma. This was the first large scale area spraying.

c. "DDT Airspraying Experiment at Ledo, Assam,"¹⁷ by Henry M. Gelford, 1st Lt., SNC. The experiment was set up to check the effectiveness of air spraying in jungle, semi-jungle, and open field situations.

d. "Dumara Experiment,"¹⁸ by Capt. John Wilson, to determine (1) the effectiveness of aerial spraying under monsoon conditions and (2) the proper interval between spray applications.

e. "DDT as a larvicide," by Capt. Louis C. Kuitert. The objections of the experiment were:

(1) To determine the residual effect of DDT sprays when used as a larvicide.

(2) To determine the effectiveness of 5% DDT emulsion spray against anophelene larvae.

(3) To determine the effectiveness of DDT larvicides as compared to the usual malariol spray.

Notes on Anti-Malaria Units Which Served
in India and Burma (in operation on
1 December 1944)

7th MALARIA SURVEY DETACHMENT - Col FB, T/O & E 8-500

This organization was one of the first three survey detachments to reach INDIA. It arrived by echelon during the period 25 April to 16 May 1943 and was assigned to the areas occupied by American troops in BRAHMAPUTRA RIVER VALLEY. During 1943, it functioned mainly as a control organization and in 1944 resumed its survey functions in Intermediate Section.

9th MALARIA SURVEY DETACHMENT - Col FB, T/O & E 8-500

This unit was one of the first three survey detachments to be assigned to the CBI and reached INDIA on 19 April 1943. It was assigned to malaria survey activities in the CALCUTTA and lower GANGES RIVER areas.

MEN FROM MALARIA SURVEY UNIT CHECKED SPLEEN AND
BLOOD OF NATIVES TO LOCATE THE RESERVOIRS
OF MALARIA



COLLECTION OF MOSQUITOES
AND LARVAE





STUDIES OF BLOOD AND MOSQUITOES WERE MADE IN THE
LABORATORIES OF MALARIA SURVEY UNITS



17th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA 21 June 1943 and was assigned to the area of ONDAL where it provided malaria control service for aerodromes in the vicinity. Inactivated 22 October 1945 (GO 249, Hq USF IBT, 24 October 1945).

18th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA on 31 May 1943 and was assigned to duty at stations along the BRAHMAPUTRA RIVER VALLEY including JORHAT and TEZPUR. In this area it provided malaria control service for aerodromes and for service troops along the line of communications to ASSAM.

18th MALARIA SURVEY DETACHMENT - Col FB, T/O & E 8-500

This organization reached INDIA 20 October 1943 and was assigned to Northern Combat Area Command on 8 April 1944 after having served in the LEDO area. It provided malaria survey service for combat troops advancing into BURMA during the campaigns of 1944 and 1945. After the campaign was completed it was transferred to S.O.S. with headquarters at MYITKYINA, BURMA, and inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

30th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit arrived in INDIA 20 October 1943 and was established at CHABUA to provide malaria control for air-fields in ASSAM and along the BRAHMAPUTRA RIVER VALLEY. Late in September 1945 it completed its work and in October it was shipped to the United States as a Category IV unit.

32nd MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA on 20 October 1943 and was assigned the mission of carrying out malaria control in the BRAHMAPUTRA RIVER VALLEY along the line of communications from LALMANIRHAT toward the LEDO area. Inactivated 22 October 1945 (GO 249, Hq USF IBT, 24 October 1945).

35th MALARIA SURVEY DETACHMENT - Col FB, T/O & E 8-500

This detachment reached INDIA 8 April 1944 and was assigned to Advance Section with station at LEDO in ASSAM (GO 54, Hq SOS USAF CBI, 29 April 1944). It provided malaria survey services for the Base troops stationed in the vicinity of LEDO. Inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

43rd MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

Activated in CBI on 14 June 1943 (GO 7, Rear Echelon Hq USAF CBI, 14 June 1943). Its enlisted men were obtained from S.O.S. hospitals and were trained by officers of the U.S.P.H.S. engaged in malaria control activities for the Theater. It initially served in the vicinity of ONDAL and in February 1944 was assigned malaria control duties for airfields of the XX BOMBER COMMAND in the area around KALAIKUNDA. Inactivated 26 October 1945 (GO 261, Hq USF IBT, 31 October 1945).

44th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

Activated in CBI on 14 June 1943 (GO 7, Rear Echelon Hq USAF CBI, 14 June 1943). Its enlisted men were obtained from S.O.S. hospitals and were trained by officers of the U.S.P.H.S. It served at PANDU on the line of communications in the BRAHMAPUTRA RIVER VALLEY.

45th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit was activated in CBI 14 June 1943 (GO 7, Rear Echelon Hq USAF CBI, 14 June 1943) with enlisted men from S.O.S. hospitals and officers of the U.S.P.H.S. It operated initially in Advance Section and then was assigned to N.C.A.C. to provide malaria control for combat troops in MYITKYINA, BURMA. At the end of combat it was transferred to S.O.S. on 20 February 1945 and inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

46th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit was activated in CBI on 14 June 1943 (GO 7, Rear Echelon Hq USAF CBI, 14 June 1943) with enlisted men from S.O.S. Hospitals and officers of the U.S.P.H.S. It was stationed at areas along the STILWELL ROAD, and in 1944 was assigned to N.C.A.C. to provide malaria control between LEDO and MILE 50. It was returned to the control of S.O.S. in 1945 and inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

47th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 15 February 1944 and served at stations in BENGAL Province (TEZPUR, KURMITOLA, CHITTAGONG, SYLHET) (GO 22, Hq SOS USAF CBI, 16 February 1944). Inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

48th MALARIA CONTROL DETACHMENT - Col FA T/O & E 8-500

This unit reached INDIA 1 February 1944 and was one of the first two malaria control detachments to be assigned to LEDO. It furnished malaria control for the base. Inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

49th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 1 February 1944 and was one of the first two malaria control detachments to be assigned to LEDO. It was placed under N.C.A.C. and provided malaria control for combat troops at SHING-BWIYANG, WARAZUP, AND KAMAING, BURMA during the campaigns of 1944 and 1945, remaining at BHAMO, BURMA after the end of combat. It was transferred to S.O.S. on 20 February 1945 and inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

50th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA on 1 February 1944 and was moved to Intermediate Section where it provided malaria control at CHABUA and DINJAN, ASSAM. Inactivated 10 October 1945 (GO 238, Hq USF IBT, 13 October 1945).

51st MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit arrived in INDIA 1 February 1944 and was assigned to Intermediate Section where it provided malaria control at TEZPUR and MISAMARI, ASSAM. Inactivated 10 October 1945 (GO 238, Hq USF IBT, 13 October 1945).

72nd MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA 1 June 1944 and was assigned to the area around CHAKULIA, west of CALCUTTA, where it furnished malaria control service for aerodromes in the area. Later it carried on similar activities for bases of the XX BOMBER COMMAND at KHARAGPUR, BENGAL.

73rd MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA 1 June 1944 and was moved to BURMA where it was assigned to N.C.A.C. and furnished malaria control in areas occupied by combat troops during their advance into Central Burma. It followed the combat lines from SHINGBWIYANG to LASHIO and after cessation of combat, it was transferred to S.O.S. on 20 February 1945 and worked at MYITKYINA and WARAZUP. Inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

112th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 23 November 1944 and was assigned to KARACHI where it provided malaria control at the port and at Air Force installations in the area. Reduction of activities at KARACHI in 1945 rendered this unit excess and it was transferred to China Theater in June 1945 (SO 179, Hq USF IBT, 28 June 1945).

113th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA 23 November 1944 and was stationed at ONDAL, BENGAL, where it provided malaria control for Air Force and service troops in the vicinity. Inactivated 15 November 1945 (SO 287, Hq USF IBT, 24 November 1945).

114th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 23 November 1944 and was stationed first at CALCUTTA and then at KURMITOLA to carry out malaria control for troops in the area. It was transferred to China Theater in May 1945 (SO 146, Hq USF IBT, 26 May 1945).

116th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 23 November 1944 and was assigned to N.C.A.C. In BURMA it provided malaria control at WARAZUP and MYITKYINA. It was transferred to S.O.S. 20 February 1945 and inactivated 19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

117th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 23 November 1944 and was assigned N.C.A.C. to provide malaria control for troops in the vicinity of SHINGBWIYANG, BURMA. It was transferred to S.O.S. on 20 February 1945 and inactivated

19 October 1945 (GO 244, Hq USF IBT, 22 October 1945).

119th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 23 August 1945 and was assigned to KARACHI to provide malaria control for the ATC base and the port of embarkation at that location.

123rd MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA 23 January 1945 and was assigned to N.C.A.C. to provide malaria control at MILE 19, STILWELL ROAD. It was transferred to China Theater in June 1945 (SO 181, Hq USF IBT, 30 June 1945).

124th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This unit reached INDIA 23 January 1945 and was assigned to Base Section to provide malaria control at Replacement Depot No. 3, KANCHRAPARA.

125th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment reached INDIA 23 August 1945, and was attached to the AAF on 7 September 1945 to assist in DDT airspray operations (SO 250, Hq USF IBT, 7 September 1945).

164th to 171st (inclusive) MALARIA CONTROL DETACHMENTS

Col FA, T/O & E 8-500

These detachments reached INDIA 23 January 1945 and were assigned to carry out malaria control at stations indicated:

164th MCD - TEZGAON; inactivated 15 Nov 45 (GO 287, Hq USF IBT, 24 Nov 45)

165th MCD - CHABUA; left CHABUA 18 Sep 45 for return to U.S.

166th MCD - LEDO

167th and 168th MCD'S - China Theater

169th MCD - CALCUTTA

170th MCD - CHABUA; trfd to China Theater 26 May 45

171st MCD - LEDO; inactivated 21 Oct 45 (GO 252, Hq USF IBT, 3 Nov 45)

(GO 20, Hq SOS USAF IBT, 24 Jan 45; SO 146, Hq USF IBT, 26 May 1945).

173rd MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment was activated in CBI 11 September 1944 (GO 140, Hq SOS USF IBT, 11 September 1944) and was assigned to CHABUA. From February to October 1945 it was attached to the AAF to assist in carrying out air-spraying of DDT (GO 45, Hq SOS USF IBT, 26 February 1945; SO 278, Hq USF IBT, 5 October 1945).

174th MALARIA CONTROL DETACHMENT - Col FA, T/O & E 8-500

This detachment was activated in CBI on 22 September 1944 (GO 119, Hq USAF CBI, 12 September 1944) and was assigned to N.C.A.C. at WARAZUP. In February 1945 it was attached to the AAF to assist in carrying out air-spraying operations (GO 45, Hq SOS USF IBT, 26 February 1945).

Personnel of Malaria Control
and Survey Units, IBT

<u>Name</u>	<u>Rank</u>	<u>Unit</u>	<u>Period with Unit</u>
Gaines, J.C. Jr.	Maj SnC	44th MCD 7th MSD	
Gursch, Otto F.	Maj SnC	7th MSD	
Stell, David J.	Maj SnC	9th MSU Base Sec. Malariaologist to Sept 45	
Weidenkopf, S. J.	Maj SnC	73rd MCD Dec 44 to May 45 Adv. Sec. Malariaologist May 45 to Oct 45	
Armstrong, R. L.	Capt SnC	Hq IBT Oct 45 to Dec 45 35th MSD Sept 43 to Sept 45	
Beard, F. W.	Capt SnC	107th MCD Jun 44 to Oct 45 164th MCD Oct 45 to	
Berry, Earl H.	Capt SnC	18th MCD Oct 44 to Feb 45 44th MCD Feb 45 to present	
Bierstein, Paul W.	Capt SnC	47th MCD Aug 43 to 5 Sep 45 164th MCD 5 Sep 45 to Oct 45	
Burnham, Thayer W.	Capt SnC	30th MCD Apr 43 to Sep 45 51st MCD Sep 45 to Oct 45	
Buzicky, Albert W.	Capt SnC	36th MCD Sep 43 to Oct 45	
Carr, Joe M.	Capt SnC	31st MCD	
Cothran, Malcolm L.	Capt SnC	49th MCD Sep 43 to Oct 45	
Crowder, Moody L.	Capt SnC	18th MCD Apr 43 to 23 Sep 45	
Crowley, James A.	Capt SnC	117th MCD Oct 44 to Oct 45	
Dallas, James L.	Capt SnC	17th MCD Apr 43 to 27 Apr 45	
Dominick, Clarence B.	Capt SnC	43rd MCD to Oct 45	
Grantham, George R.	Capt SnC	116th MCD Oct 44 to Oct 45 45th MCD	
Hasfurther, William A.	Capt SnC	50th MCD Aug 43 to present	
Heisel, Frederick F.	Capt SnC	48th MCD Aug 43 to Oct 45	
Johnson, Robert P.	Capt SnC	165th MCD Jan 45 to present	
Johnson, Russell L.	Capt SnC	73rd MCD July 45 to Oct 45	
Kuitert, Louis C.	Capt SnC	18th MSU Aug 43 to Oct 45	
Lee, Harry H.	Capt SnC	17th MCD 24 Jul 45 to 5 Sep 45 32nd MCD 5 Sep 45 to 17 Oct 45	

<u>Name</u>	<u>Rank</u>	<u>Unit</u>	<u>Period with Unit</u>
Martin, Deal F.	Capt SnC	9th MSD 35th MSD 166th MCD	Jul 45 to Jul 45 Jul 45 to Sep 45 Oct 45 to present
McGregor, Theodore	Capt SnC	7th MSD	
Miles, Virgil	Capt SnC	18th MSD	
Morgan, Clifford L.	Capt SnC	114th MCD	Nov 44 to present
Oliver, John C.	Capt SnC	32nd MCD	Jun 43 to present
Rehn, John W. H.	Capt SnC	35th MSD 9th MSD	Sep 43 to Jul 45 Jul 45 to present
Ruzika, Joseph W.	Capt SnC	166th MCD	Jan 45 to Oct 45
Sherman, Leslie K.	Capt SnC	17th MCD 113th MCD	6 Sep 45 to present Mar 44 to
Smith, Lyle H.	Capt SnC	112th MCD	Oct 44 to Jul 45
Stapleton, Ken K.	Capt SnC	72nd MCD	Jan 44 to Nov 45
Van Breda, Anthony J.	Capt SnC	31st MCD	Aug 45 to present
Valenza, Noel C.	Capt SnC	123rd MCD	Jan 45 to Jul 45
Wagner, Clarence O.	Capt SnC	124th MCD	Jan 45 to Oct 45
Wall, Thomas H.	Capt SnC	51st MCD	Nov 43 to Sep 45
Wilson, John W.	Capt SnC	7th MSD 173rd MCD	Mar 43 to Sep 44 Sep 44 to Oct 45
Beecher, John L.	1st Lt SnC	174th MCD	
Blakeslee, Theodore E.	1st Lt SnC	45th MCD	Jun 44 to Feb 45
Decker, Herbert M.	1st Lt SnC	170th MCD	Jan 45 to
Edwards, Delmer E.	1st Lt SnC	46th MCD	8 May 44 to Oct 45
Ellis, Thomas G.	1st Lt SnC	18th MCD	
Harrington, Robert W.	1st Lt SnC	44th MCD 18th SMD 45th MCD	Apr 43 to 25 Feb 45 25 Feb 45 to Sep 45 Sep 45 to Oct 45

<u>Name</u>	<u>Rank</u>	<u>Unit</u>	<u>Period with Unit</u>
McGowan, Thomas F.	1st Lt SnC	171st MCD Hq Base Sec	Dec 44 to Oct 45 Oct 45 to present
Merriman, Francis W.	1st Lt SnC	169th MCD	Jan 45 to
Scanling, Edward L.	1st Lt SnC	164th MCD 174th MCD	Aug 44 to 5 Sep 45 5 Sep 45 to present

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1. Memorandum from Office of Surgeon CBI, to Commanding General SOS USAF CBI, 12 February 1943, "Malaria Control Units." Reviews negotiations for first units.
2. Memorandum, 12 February 1943, cited above.
3. Letter, semi-monthly report for period 15 June to 30 June from Advance Section #2 to Surgeon Advance Section #2. Par. 4 describes deployment of personnel.
4. Letter, Office of Surgeon General to Surgeon SOS CBI, 14 January 1943. Reviews anti-malaria organization being radioed for shipment.
5. The 43rd, 44th, 45th, and 46th Malaria Control Units were activated in CBI per GO 7, Rear Echelon Hq USAF CBI, 14 June 1943.
6. SO 99, Hq USAF CBI, 8 April 1944.
7. See charts and graphs in statistical section of this chapter.
8. Periodic Report of malaria control activities of 35th Malaria Survey Detachment, June 1945.
9. Remarks made to author while discussing malaria with newly arrived personnel in Advance Section.
10. Information taken from the Semi-monthly progress reports submitted during 1943 by the U.S.P.H.S. officers and the Army malariologists.

11. Checkslip from Surgeon CBI, 4 July 1944, to Deputy Chief of Staff, "Insecticides": "During June, 1300 lbs were received and this now being used in Advance Section #2 and Base Section #3. Shipments en route are:

<u>Ship No.</u>	<u>Amount</u>	<u>ETA</u>
LA 929	1300	1 July 1944
LA 1003	9840	8 August 1944"

12. Periodic reports of malaria control activities for month of May, June, July, and August 1944, Base Section #3, Intermediate Section and N.C.A.C.
13. Periodic reports of malaria control activities for 1945.
14. Copy of this report included in appendices.
15. Copy in appendices for section on Air Spraying of DDT.
16. Copy included in appendices.
17. Copy included in appendices for section on Air Spraying of DDT.
18. Copy included in appendices for section on Air Spraying of DDT.

6. Air Plane Spraying of DDT

In the early spring of 1944 a great deal of work was being done in the States with the new insecticide, DDT. It was being tested experimentally for every conceivable use and for all possible methods of application. Dispersal by airplane showed considerable promise.

Colonel Earl M. Rice, MC, US Medical Advisor, SEAC and former Theater Malariaologist, CBI, was in the United States at the time, observed the experiments and decided that both DDT and airplane spraying are potentially important to the CBI Theater and justified further "on the ground" study. He secured 200 pounds of DDT and two sets of Hausman spray adapters for liaison planes and arranged to have them flown to this Theater.¹ They arrived on April 1944 and work was started soon afterwards. The initial supply of DDT was small but greater amounts were promised for the future.

Chabua, Assam, was selected as headquarters for the DDT experiments; it had the mosquitoes, the Air Corps facilities, and a malaria survey unit to check results.

Major Mantz, MC, Theater Malariaologist undertook to conduct the experiments.² He served only 5 days (from 8 June until 13 June 1944) before he was reassigned to duty in the States. His successor was Major Joseph Vivas, MC.³ who continued in charge of the DDT experiments until relieved by Colonel Rice on 29 July 1944.⁴ Colonel Rice remained in charge during the remainder of the experimental era. He left Chabua about 1 October 1944.

The first experiment was done with an L-4 Cub plane equipped with the Hausman accessories that accompanied the first DDT shipment. It demonstrated that air spray was effective against both larvae and adults but that the plane was entirely too small for the job in this Theater.⁵

Subsequently the P-40, P-47, and B-25 planes were investigated.⁶ The P-40 with 3 CWS, M-10 tanks (33 gallons) was found to have too small a capacity, travelled too fast (resulting in patchy distribution), had no control over outlet valves, and had poor flying characteristics at tree top level. It was discarded. The P-47 was investigated, but it, too, had many of the same unsuitable characteristics as the P-40 and was also discarded.

The B-25 had many desirable characteristics; it had the essential large carrying capacity, long range, and maneuverability. It was therefore equipped with a 585 gallon bomb bay tank, an M-33 CWS discharge tube, suitable outlet valve and an operating lever. Experiments with this equipment indicated that under normal conditions the following could be expected:

a. Each plane load of 585 gallons of 5% DDT solution would be spread over a swath about 200 yards wide and 9 miles long.

b. The rate of dispersion across the swath was reasonably uniform.

This plane and equipment was then field tested at Myitkyina, Burma in September and October 1944, and found to give good results.⁷ It was adopted as standard for the Theater.

By the fall of 1944, after six months of trial and error, experimentation, development, and spraying, an organization was visualized which, it was felt, would meet the needs of this Theater. It consisted of:^{8, 9}

3 B-25 planes modified for air spraying
6 L-5 cub planes modified for air spraying
2 M-4 CWS apparatus decontaminating for mixing DDT solutions
10 pilots and ground maintenance personnel
2 malaria control units for handling DDT, mixing, filling planes, etc.
1 malaria survey unit to make entomological investigations.

This organization was completed by February 1945 and continued in operation throughout the entire season. It was operated by the Air Corps under the name of The "India Burma Air Spray Flight." The two malaria control units (the 173rd and 174th) were attached by SOS.

In addition to Colonel Rice, Major Mantz, Captain William Hartman, AAF, and Major Vivas were identified with the early air spraying experiments. Captain John Wilson, SnC, Commanding Officer, 173rd Malaria Control Unit, also worked with the experiment and then continued in charge of operations through the fall of 1944 and until the unit was inactivated at the end of the war.

Much of the credit for the practical success of the Air Spray Unit must be given to Captain Wilson, who drew up the initial plans and supervised the operation of the flight until November 1945. The flight played an important part in the malaria control program of Advance and Intermediate Sections during the transmission season of 1945. It participated in the later stages of the Central Burma Campaign. Over 70,000 pounds of DDT were air sprayed in the form of 5% kerosene solution during its 9 months of activity.

MIXING AND LOADING DDT SOLUTION FOR AIRSPRAYING



B-25 PLANE IN FLIGHT DURING DDT AIRSPRAYING OPERATIONS



Problems Encountered

Weather

The monsoon weather of this Theater definitely limited the effectiveness of DDT spraying by air craft. It not only "washed away" the DDT but frequently prevented the planes from reaching their objectives.

Experimental work was undertaken by the India-Burma Malaria Spray Flight in July 1945 to check the effectiveness of aerial spraying under monsoon conditions.¹⁰ The conclusions indicated by these tests were:

"1. Where spray applications are followed within a few hours by rain, the effectiveness of the spray material is greatly reduced.

2. The continued low mosquito population in areas treated since 1 March is due to the early reduction of the mosquito population during the pre-monsoon season.

3. In order to bring the mosquito population under control during the monsoon season it will be necessary to make applications more often than 14 days or use a higher concentration of DDT. However, no data is available on the effectiveness of a higher percentage of DDT.

4. Under the conditions of this experiment the effective period following an aerial application of 5% DDT-oil is no more than three days."

Frequent delays were experienced because of unsatisfactory flying weather. The monthly reports of the spraying unit contained statements such as: "During the last 12 days of May heavy monsoon rains fell in Assam and Burma. Only one day of the twelve was suitable for spraying." "The rains are making it impossible to carry out spray schedules set up as much as two weeks in advance."

"A dry weather experiment at Ledo, Assam on 4 March 1945 gave an excellent kill even under dense foliage."

Topography

The rough, mountainous terrain of eastern Assam and Burma made air spraying of these areas especially difficult. Frequently the area to be sprayed would be located in a pocket in the hills or just adjacent to a mountain, creating exceptional flying hazards. Frequently

the planes could not cross the "little hump" from Assam into Burma because of the weather, and would have to turn back without making the scheduled spraying.

Ground-Air Liaison

Close contact between the malaria personnel on the ground and those operating the spray planes was absolutely essential.¹² Failure of this liaison resulted in wastage of materials because of unnecessary spraying, and prejudice to the control program due to areas not being sprayed at the proper time or not being sprayed at all.

Air spraying was established in this Theater on the premise that it would supplement ground work and be especially useful in rapidly controlling newly captured areas. It was not as effective in either of these objectives as it would have been if there had been closer contact between the personnel on the ground and those flying the planes. The base of operations of the spray flight and the areas to be sprayed were too far apart both geographically and administratively to achieve the maximum benefit. It sometimes happened that in the rapidly fluctuating forward area the needs for spraying would change completely between the time that the request was initiated and the time the planes arrived to do the spraying.¹³ Close coordination and planning with the ground work, would have greatly improved the program.

Organization and Administration

Any new organization for which there is no precedent undergoes a period of growing and evolution until it finally shakes down into an efficient unit. Air spray started as an experiment and grew until it was operating over bases from Calcutta to Lashio. The organization to operate it grew with it.

There were certain basic organizational difficulties which were never completely overcome. The three major subdivisions of the Theater, (S.O.S., A.A.F., N.C.A.C.,) were all interested and involved in this project. The Air Corps had the planes, pilots and maintenance facilities. S.O.S. was responsible for malaria control,^{14,15} it had the anti-malaria units that did the ground work, and knew the needs for air spray. N.C.A.C. had an area of responsibility, anti-malaria units on the ground, and a rapidly fluctuating front that needed air spraying.

The India Burma Air Spraying Flight was assigned to the A.A.F., but its primary objectives,¹⁶ supplementing the ground work and spraying newly captured areas, were responsibilities of S.O.S. and N.C.A.C. The administrative problems were numerous and complex but the over all results obtained were as good as could be expected in a Theater when distinctions between Air and Ground Forces authority were so sharply drawn.

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1. Ltr, 30 May 1944, Colonel Rice, US Med Adviser SEAC to Theater Surgeon, USAF CBI. "Subsequent to this letter arrangements were made for the shipment of two sets of Hausman spraying equipment for use with cab planes, and 200 lbs of DDT powder to be shipped by air to Colonel Flickinger. These have arrived and, as you are aware, Major Mantz has undertaken an experiment with them."
2. Ltr, 8 June 1944, CG USAF CBI to CG ASC, ATC, & SOS, "Experiments in Operational Use of DDT." Designates Major Mantz, MC, Theater Malariaologist to conduct experiments in dissemination of DDT from aircraft and ground.
3. Ltr, 13 June 1944, CG USAF CBI to CG SOS, AAF, ATC, "Experiments in Operational Use of DDT." Designates Major Joseph Vivas, Theater Malariaologist, to coordinate and supervise experiments in DDT dissemination from airplanes and ground.
4. Ltr, 29 July 1944, Office of Surgeon to Major Vivas, "Colonel Rice will take over the direction of the work from you and you are to continue as his assistant."
5. Ltr Report, 20 October 1944, from Wilson to Surgeon Hq Advance Section #2, "Report on Airplane Spraying of DDT at Deamalis Tea Garden."
6. Ltr Report, 20 October 1944, from Colonel Rice to CG USAF CBI, "DDT Air Spray Experiments." This is the preliminary report of experiments carried out in CBI Theater.
7. Ltr Report, 31 October 1944, from Kuitert, CO 18th Malaria Survey Unit, to Malariaologist Base Section #3. "DDT Experimental Results at Mars." This is an entomological report of the mosquito population before and after air spraying the Mars Camp just north of Myitkyina.
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9. Final Report of Colonel Earle M. Rice, MC, covering the DDT Air-spraying experiments from July 1944 to October 1944.

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14. Ltr Order, 10 April 1944, SOS, 725.11, from CG USAF CBI to CG SOS, "Malaria Control." Places responsibility for malaria control in the commanders of Base, Advance and exempted stations.
15. Circular No. 11, 31 January 1945, Hq USF IBT, "Malaria Control." Outlines command responsibilities in paragraph 4.
16. Memorandum No. 49, 28 April 1945, Hq SOS IBT, "Airspraying with DDT."

7. Support of Combat Troops

As the North Burma Campaign progressed into the world famous, malaria famous Hukawng and Mogaung Valleys, it became apparent that a closely integrated malaria control program within the combat forces would be necessary. The existing malaria organization in the forward area was therefore divided into two branches, one to operate at fixed S.O.S. bases, and the other to work in the forward area and provide all possible protection for combat personnel. The work of the second group, assigned to Northern Combat Area Command on 8 April 1944,¹ is discussed in this chapter.

The original organization consisted² of a malaricologist (Captain Richard E. Brown, MC), the 18th Malaria Survey Unit, and the 45th, 46th and 49th Malaria Control Units. A few months later (2 June 1944) the 73rd Control Unit arrived from the States and joined the organization.³ About a year later the 116th, 117th, 123rd, and the 174th had also arrived⁴ to supplement the existing group. This organization of one survey and eight control units continued until the Japs had been driven from North Burma and the combat mission completed. All units were then transferred to S.O.S. on 20 February 1945;⁵ assigned to Advance Section. Actually there was no movement of units at that time, but only a shift of command.

At the time that a separate anti-malaria organization was set up for the combat forces, the active front line was just forward of Shingbwiyang. Ledo was the base of operations and all territory between it and the front at Shingbwiyang was in the combat zone. It was therefore directed⁶ that the N.C.A.C. malaria units accept responsibility for the area forward of Ledo, and serve all troops within that area (N.C.A.C., S.O.S., and A.A.F.). This was a reasonable and just division of territory at that time, but it was never revised, and as the campaign progressed the assigned area became increasingly larger. Eventually, when the front was at Lashio, all of North Burma and part of Assam were in the territory assigned to the N.C.A.C. units. It could not be abandoned because it was now teeming with S.O.S. and A.A.F. personnel. As the area to be protected increased in size and importance additional units were assigned⁷ to N.C.A.C. (the 116th, the 117th, the 123rd, and the 174th Control Units), but served only S.O.S. and A.A.F. troops.

The anti-malaria units actually supporting and moving forward with combat personnel performed a highly desirable function. They not only provided maximum protection for those present, but performed the pioneering work for the resident malaria units that followed and effected the permanent control program. Living and operating conditions were usually uncertain and difficult.⁸ Personnel got into newly captured areas by whatever means were available (jeep, truck, liaison plane, cargo plane, ponton boat, Chinese supply trucks, jeep train, and sometimes just "waded through"). Equipment and supplies came in over the

same difficult lines of communication except that certain items could be air dropped.

There could not be any previously conceived and systematically executed plan of operations for these units. There were too many variables and uncertainties, such as changing combat situation, tropical storms that washed out roads and bridges, supplies that might arrive in hours or it might be weeks, and communications that were just as uncertain. The personnel did get into their assigned areas and they did everything they could with what they had. The jobs which these units frequently accomplished were: 9, 10

a. DDT residual spraying. Malaria personnel moved into newly captured areas as quickly as possible after the actual fighting had stopped. After billets and headquarters buildings had been selected and cleaned of debris, they were sprayed with DDT before occupancy.

b. DDT spraying of tents, latrines, mess halls, and other buildings.

c. DDT perimeter spraying around the camp areas. This included not only the usual strip around the camp but also all natural resting places within the camp area (fox holes, underground chambers, hollow trees, dense shrubs, etc.).

d. DDT spraying of front line installations and fortifications. This was undertaken only when the combat units were static or resting. Anti-malaria personnel provided the materials, equipment, and supervision of the combat personnel.

e. Minor larvicing and ditching around headquarters areas.

f. Transportation and issuing of anti-malaria supplies.

Air plane spraying of DDT was in operation during the latter phase of the campaign. It showed exceptional promise¹¹ as a tool to establish quick control over newly captured areas. However, the maximum benefits were not always obtained because of the rapidly changing front and because of the great distance between the base of operation of the spray flight and the combat zone. Also, the combat staff was reluctant to let the DDT plane spray too closely to the front lest it be mistaken for gas and precipitate chemical warfare.

In April 1944, when the separate N.C.A.C. anti-malaria organization was created, the assigned units were deployed¹² from Ledo to the Naga village of Shingbwiyang. As new territory was captured, anti-malaria details went forward to establish supply dumps and initiate control work. In June the 73rd Malaria Control Unit arrived from the Zone of Interior and moved up to Shingbwiyang¹³ to assist the 49th Malaria Control Unit (already there) and to initiate control work at the forward points of Tingkawk Sakan, Shaduzup, and Warazup.

The Myitkyina airstrip was captured on 17 May 1944. As soon as the combat perimeter was sufficiently large to permit malaria control work, the 45th Malaria Control Unit was flown in (Lt Theodore Blakeslee commanding on 4 July 1944) and anti-malaria work started.¹⁴ The town of Myitkyina fell on 3 August 1944. As this was the largest city in North Burma and destined to become the largest and most important American base in Burma, considerable control work was necessary. The 73rd Malaria Control Unit was flown up from Shingbwiyang to work in Myitkyina¹⁵ and extend control forward in support of the advancing combat troops.

The Central Burma campaign got under way in October 1944 and progressed rapidly. One prong of the advance moved down the "Railroad Corridor" from Mogaung toward Katha and Mandalay, the other down Eastern Burma to Bhamo and thence to a junction with the Burma Road at Mong Yu and on to Lashio. Malaria control and survey personnel moved forward on both of these fronts, initiating control programs for all troop concentrations. The 18th Malaria Survey Unit performed the survey work in Burma; the 73rd Malaria Control Unit was designated as the unit to remain highly maneuverable and move forward quickly to initiate control programs in newly occupied areas.

The usual procedure was for the commanders of the survey and control units to make joint inspections of all newly captured areas. They inquired into the future use of the area (whether it was to be used as a base for American troops) and the extent of malaria in the area. With this information a course of action was determined (whether control work was to be undertaken, whether it should be of a permanent or temporary nature, and whether airplane spraying was desirable). If anti-malaria work was indicated, a detail of the 73rd Malaria Control Unit would be moved in with essential equipment and a stock of materials and supplies. The program would be initiated and continued until the troops evacuated the area or a fully equipped unit moved up to establish a permanent control program. Tingkawk Sakan, Mogaung, Shaduzup, Warazup, Hopin, Mohnyin, Mawlu, Namti, Sawmah, and Bhamo were occupied in this manner.

Another detail from the 73rd MCU was attached to the 5332d Brigade (Mars Task Force) to handle malaria control supplies and supervise the control work of this combat unit. It joined the Brigade at Bhamo and continued with it through the Central Burma campaign.

Temporary control programs were established at Momauk, Namhkam, Tonkwa, Si-U, Kutkai, and Lashio.

The experiences at Bhamo were typical of how the anti-malaria organization functioned during the Central Burma campaign. As the fighting progressed down through Burma and approached Bhamo, information was passed down through the Surgeon's office that Bhamo was to be quickly converted into a large base of operations. N.C.A.C. and 10th Air Force would move their headquarters there and S.O.S. would set up a large work and housing area. Bhamo's pre-war malaria record was investigated and found to be bad.

While fighting for the city was still in progress, a reconnaissance was made of the captured portion of the city and the adjacent native villages by the survey entomologist (Captain L.C. Kuitert) and the commanding officer of the control unit (Captain S. J. Weidenkopf). Entomological specimens were collected and sufficient other evidence was found to justify the decision that the malaria situation throughout the city was as bad or worse than before the war, and that malaria control work must be inaugurated immediately after the town's capture. Transportation into Bhamo was investigated and found to be difficult. There were only two supply lines. One was by air to a small rice paddy landing strip at Momauk (the Bhamo landing field was still trenched and mined, and not in operation). The other supply route was a dry weather, one track road over the mountains from Myitkyina. Although it was in poor condition and was currently being used by everything from slowly moving pack trains to Chinese operated tanks, it was found to be the only possible means of moving supplies and equipment forward. There were no transport facilities, POL's, or transient messes; every organization operated on its own resources. These conditions dictated the use of a small, maneuverable detail, one that could get in and get to work quickly. After facilities had become available, a full sized, fully equipped, control unit was to be moved in and to take over the permanent control program.

Bhamo fell on 18 December 1944. The temporary malaria detail (from the 73rd Malaria Control Unit) left Myitkyina the next day and a few days later was a "going concern" in Bhamo. The detail took two trucks (a weapons carrier to stay in Bhamo, and a cargo truck to shuttle supplies from Myitkyina), malariol DDT solution, knapsack sprayers, mosquito netting, hessian cloth, aerosol dispensers, and repellent.

At the time that the malaria control detail moved into Bhamo, the entire military population consisted of 2 N.C.A.C. Officers and an American and a Chinese Combat MP Detachment. Expansion started within a few days and it was soon an important N.C.A.C., SOS, and 10th Air Force base.

The first day's job for the malaria detail was to set up living quarters for themselves and storage space for their supplies.

One of the least bombed-out buildings was selected, debris cleaned out, and mosquito-proof living quarters constructed on the second floor. Cooking facilities were set up in the yard at the rear of the building, and anti-malaria supplies were stored on the first floor. On the next day the cargo truck went back for more supplies, and DDT residual spraying and larvicide were initiated.

Within a few days all the various organizations began moving into Bhamo and setting up their camps. From then on it was a race against time to keep the supplies ahead of the demand, to spray out the newly constructed billets and tent areas before they were occupied, and to larvicide the bomb craters, shell holes, and lagoons before they became breeding areas.

Christmas was a "work-as-usual" day for the personnel at this embryonic base. It was remembered because of a special food ration that was flown in (canned turkey, cranberry sauce, and candy) and also because the Japs used it as a last attempt to get back into the city. Malaria control personnel were called out for patrol and perimeter duty along with others in the area. A few days later the Japs bombed this base for the last time, concluding the combat activities. However, the booby traps, land mines, and thousands of unexploded bombs and projectiles were a constant menace to malaria control work for months to come.

Several weeks later (18 January 1945) the permanent control unit (the 49th Malaria Control Unit), complete with personnel and equipment, moved in. It set up a permanent headquarters and took over the anti-malaria program. The initial detail then moved forward to its next assignment.

At the conclusion of the Burma campaign, N.C.A.C. recognized the work of its original anti-malaria organization (18th Malaria Survey, 45th, 46th, 49th, and 73rd Malaria Control Units) by initiating commendations which were published in General Order No. 11, Hq USF IBT, 5 June 1945.

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2. Letter from Theater Surgeon to Surgeon Chih Hui Pu, 29 February 1944. Regarding assignment of Captain Brown, the 18th Malaria Survey Unit, and the 46th, 47th, and 49th Malaria Control Units to combat.

3. Annual Report of the 73rd Malaria Control Unit for 1944.
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6. Circular 36, Rear Echelon Hq USAF CBI, 1 April 1944.
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8. Personal experiences of the author as Commanding Officer of the 73rd Malaria Control Unit.
9. Annual Report of the 73rd Malaria Control Unit, 1944.
10. Periodic Report of Malaria Control Activities, 73rd Malaria Control Unit, for July to December 1944; January and February 1945.
11. Letter Report from Kuitert, Commanding Officer, 18th Malaria Survey Unit, to Malariaologist Base Section #3, 31 October 1944, "DDT Experimental Results at Mars." Describes mosquito reduction after air spraying at Mars Camp.
12. Periodic Report on Malaria Control Activities for the month of May 1944, from Hq NCAC.
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14. Periodic report cited in Note 13, above.
15. History of the 73rd Malaria Control Unit, 1944, and Periodic Report of Malaria Control Activities for month of August 1944, from Hq NCAC.
16. From NCAC periodic reports of Malaria Control Activities during last half of 1944 and first 2 months of 1945.
17. Histories of the 18th Malaria Survey Unit and the 73rd Malaria Control Unit.
18. Personal experiences of the author as Commanding Officer of the 73rd Malaria Control Unit.

8. Anti-Malaria Supplies and Equipment

The first anti-malaria supplies to arrive¹ in the Theater were some that had been shipped to the Yunnan-Burma Railroad but were diverted to India when Rangoon fell to the Japanese. The shipment consisted of pyrethrum extract, paris green, and some hand sprayers. The amounts were entirely inadequate for even the small military population in 1942.

Requisitions were prepared² during October and November for the necessary 1943 supplies. They requested 8,000 hand sprayers (flit guns), 370 pressure sprayers, open head, 70 portable power sprayers, 95,000 2 oz. bottles of repellent. Later this original requisition was enlarged to include mosquito proofing materials, sprayers, and the new aerosol dispensers.³ These items arrived during the spring and summer of 1943. As more items and greater quantities of anti-malaria supplies became available in the United States, the flow of shipments to this Theater became continuous.

All available local anti-malaria supplies were obtained on reverse lend-lease. The items obtained were screen, mosquito netting, burlap, and flit guns. These items, especially the flit guns, were inferior in quality and used only because of the lack of American goods.

During 1944 and 1945 the main supply problems were not to get adequate stocks into the Theater, but rather to get the stocks into the hands of the troops.⁴ The movement of supplies from the ports to Assam was difficult, but the movement from the railhead into Burma was even worse. Normal transport was by truck over the completed sections of the Ledo Road, but conditions during the monsoon season were not normal and too frequently the road was impassable. Air freight was utilized to supplement motor transport and to get supplies to the forward dumps ahead of the road. However, shipments were necessarily limited to emergency situations and to points where no other mode of transport was available.

In the Base Section No. 3 report for May 1944, Major Seltzer, Base Malariaologist, described the problem:⁵

"Getting supplies forward to Captain Brown (N.C.A.C. Malariaologist) has become a major difficulty because of road conditions. Some trucks loaded with supplies have been mired for a week or more. Every convoy that gets through carries some of our items; and whenever a truck is known to be going, supplies are loaded if there is room. Occasionally we have sent a plane load down. Because of the heavy evacuation of wounded, planes have no time to load

supplies but merely unload and take off again. A stock is kept at the field so that if cargo space is available, it is ready for quick loading. Although these supplies enjoy a high priority, an endeavor is being made to secure a high emergency priority."

During the spring of 1945 the Stilwell Road was completed and regular transport service established. Large stockpiles were established in the forward area during the dry season⁶ for use during the monsoon season when the Road was impassable.

Supplies for Personal Protection

a. Repellent. Ample quantities of insect repellent began arriving in this Theater in the summer of 1943. This was one of the few items where the supply exceeded the demand. The brands received were Indalone, Skat, Staway, 612, DMP, and Eveready. As the relative effectiveness of the various brands became known all but the DMP were discarded and returned to Quartermaster stocks.

Repellents were uniformly detested by the troops⁷ as they added greatly to the general discomfort of already very uncomfortable soldiers. They smarted when applied, they were sticky and oily, they made the user feel hot, they soiled clothes, and dissolved plastics (flashlights, jeep steering wheels, fountain pens, watch crystals). They were not used by the average soldier except under pressure from his commanding officer or by overwhelming numbers of mosquitoes.

b. Bed nets were used throughout the Theater. Early models were of poor quality, restricted air movement, and easily mildewed. They were hot and smelly. Later models were made of a tightly woven netting and were much more comfortable. Little trouble was experienced in enforcing the bed net regulations.

c. Headnets and mosquito gloves were seldom if ever worn.⁹ They were extremely uncomfortable and restricted the efficiency of the wearer.

d. Insect sprays were universally used throughout the Theater.¹⁰ Both the aerosol dispenser and the liquid spray were uniformly acceptable. Some troops preferred one, some the other. The combination of mosquito proof construction, plus an occasional spraying gave good protection. The use of DDT residual spray decreased the need for liquid sprays. The later models of hand sprayers were an excellent product.

Mosquito Proofing Materials

Mosquito proof construction was both popular and effective. It was used throughout the Theater, from the rear "basha areas" to the forward tent areas. The standard materials were burlap hessian cloth for walls and ceilings, and mosquito netting for doors and windows. The materials deteriorated rather rapidly in the jungle, but were usually effective as long as an organization was camped in one place.¹¹ Both the American pyramidal and the British EPI tents provided effective and comfortable living quarters when placed over a wooden framework, elevated to give 6' side walls, and then mosquito proofed. DDT residual spray completed the protection.

Nylon and wire screen arrived in large quantities during 1945 and was used on relatively permanent construction, such as hospitals and mess halls.

Equipment

The anti-malaria equipment was generally satisfactory. Special conditions frequently required special equipment and it was improvised or constructed to meet the particular needs. Some of the problems were:

a. Large, deep lagoons had to be larviced. None of the standard equipment was satisfactory, so a special boat-pumping unit was improvised. An engine driven pump was mounted in an assault boat and equipped with a section of fire hose and a nozzle. Water and larvicide were drawn into the pump, mixed, and then expelled through the fire nozzle. The water acted as a vehicle to carry the larvicide to otherwise inaccessible places. The boat was easily pushed about the lagoons, spraying as it proceeded.¹²

b. DDT residual sprayers. Neither the hand operated knapsack sprayers nor the engine-driven paint sprayers were entirely satisfactory for DDT. Information has been received from the United States that a new cylindrical knapsack sprayer has been designed. It may be the answer to the need for a light weight, portable DDT sprayer. Neither the DeVilbis nor the Binks power paint sprayers were entirely satisfactory. The DeVilbis was too small and lacked essential adjustments. The Binks was an excellent piece of equipment except for its undependable, two cycle engine. A good, engine driven, power sprayer is needed for DDT residual spraying.

Equipment in Forward Area, Mobile Detachments

The malaria units assigned to and moving forward with combat had a great deal of TE equipment that was never used.¹³ These units moved forward by air or over extremely difficult roads. It was necessary to keep equipment down to a minimum and concentrate on moving stocks of malariol, DDT, netting, hessian cloth and sprayers forward to the new location. On these movements, knapsack sprayers were considered as the only equipment essential to initiating a malaria control program; everything else was left behind.

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IMPROVISED EQUIPMENT FOR SPRAYING LARGE LAGOONS



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9. Anti-Malaria Organization

The responsibility for environmental malaria control in the India-Burma Theater was assigned¹ to the Commanding General, S.O.S. (zone of communications) and the Commanding General, N.C.A.C. (combat zone). The Commanding General, S.O.S. then reassigned his responsibility to the major S.O.S. Sections under his command (Base, Intermediate, Advance).² The malaria control and survey units were likewise divided and assigned to N.C.A.C. and the major S.O.S. subdivisions. This resulted in a highly decentralized organization with all the authority, responsibility, and instruments to perform the work located at Section and N.C.A.C. levels. Each Section (and N.C.A.C.) reported its actions periodically, through channels, to the Theater level.

Positions at the Theater and Section level were created to provide the necessary supervision and direction to the program. A Theater Malariaologist was placed on the staff of the Theater Surgeon and Assistant Malariaologists were placed in each Section and N.C.A.C. The Assistant Malariaologists were on the Section Surgeon's Staffs and in addition to the staff functions they also supervised and inspected the work of the malaria units. The Theater Malariaologist provided direction for the entire Theater program.

The original personnel to staff this organization came from ZI in early 1943. It was:³

Lt. Col. Earle M. Rice, MC, Theater Malariaologist
Captain F. A. Mantz, MC, Assistant Malariaologist
Lt. R. C. Brown, MC, " "
Major M. Seltzer, MC, " " " (Arrived Dec 43)

These officers were the only technically trained malariaologists to reach this Theater. As they were lost, replacements were made from within the Theater.

The position of Theater Malariaologist was held in turn by Lt. Col. Earle M. Rice, Major F. A. Mantz, Major J. R. Vivas, Major S. W. Scorse, Major M. Seltzer, and then by the Chief of the Preventive Medicine Section, Colonel Karl R. Lundeberg. The Section Malariaologist's positions were originally held by the Assistant Malariaologists sent over from the United States, but as replacements became necessary they were drawn from the Sanitary Corps officers commanding malaria control and survey units. By 1945 all the original Section Malariaologists had been replaced and the new officers were:⁴

Major David J. Stell, SnC, Base Section Malariaologist
Major J. C. Gaines, SnC, Intermediate Section "
Major S. J. Weidenkopf, SnC, Advance Section "

Because of scarcities in Sanitary Corps personnel it was frequently necessary for these officers to remain in command of a malaria control or survey unit as well as to perform the duties of the Section Malariaologist.

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10. Atabrine

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The history of atabrine in IB Theater is a recapitulation of the general experience of our Army with this valuable drug. It must now be admitted that we entered the war with only sketchy ideas as to the real usefulness and properties of atabrine. Its potentialities as a suppressive drug were almost entirely unknown in 1941 and even the proper and optimal therapeutic dosage was not too well established in spite of some ten years of experience with the drug in Army hospitals. A glance at War Department directives published between 1941 and 1943 on the use of atabrine will amply confirm this statement. This ignorance and indecision concerning atabrine was shared by the general medical profession, including experts in tropical medicine, since expert N. R. C. consultation and advice were made available to the Army during the war years and the advice of these consultant organizations was eagerly sought by The Surgeon General's Office.

In the CBI and the IB Theaters the use of atabrine was characterized by the hesitation and vacillation common to all theaters during the dark years of 1942 and 1943 when the enemy seemed destined to win either a victory or a draw decision. The frantic search for new and improved anti-malaria drugs to replace the quinine lost to Japanese arms was a measure of our early mistrust of atabrine.

The therapeutic value of atabrine was established and accepted by medical officers long before its suppressive properties were fully appreciated. Examination of medical records from CBI Theater in the first two years of the war show that atabrine was used successfully in our base and advance hospitals more or less in accordance with the suggestions and directives published by The Surgeon General's Office. No particular effort seems to have been made to employ the drug on a large scale for its "prophylactic" effects during the campaigns of 1943. This was natural in view of the then current War Department policy which deprecated suppressive treatment in favor of mosquito control and personal protective measures. A Theater-wide malaria directive published 8 April 1943 stated in par. 2 a (5) "Use of drugs for suppression of malaria symptoms, an emergency measure, (is) to be employed only where other methods are impracticable, or inadequate, and (is) dependent on military necessity when ordered by the commander concerned on advice of the Chief Surgeon concerned."¹ Again on 7 August 1943 a Theater directive stated, "Prophylactic administration of drugs against malaria is to be carried on only when directed by the Theater Commander."²

In the spring of 1944 as Chinese and American forces moved out of the Ledo area to challenge the Japanese hold on North Burma, there were attempts to employ atabrine as a prophylactic drug in the troops exposed to the unprecedented malaria hazards of this hyperendemic zone.

The first mass atabrinization of troops was started 15 April of that year when the administration of one tablet atabrine daily was prescribed for "all American and Chinese troops operating in Upper Burma forward of Shingbwiyang and west of Paoshan, Yunnan Province, China."³

Some months later the atabrine zone was extended northward to include the extreme northern tip of Burma forward of the Tirap River (some miles east of Ledo). In September 1944 it was decided to continue the suppressive program indefinitely beyond the originally planned termination date of 15 November. At the same time units and individuals leaving the above areas were directed to continue taking atabrine for at least 4 weeks after departure.⁴

These early programs of suppressive treatment were not successful as can be seen by an examination of the malaria rates in Northern Combat Area Command (Burma). The July 1944 Malaria Report from N.C.A.C.⁵ records 5.8% of American troops as malaria casualties (696/1000/annum). Here as elsewhere in all tropical theaters of operation, the causes were manifold; lack of understanding of the suppressive action of atabrine; poor discipline and indifference; poor morale, and hostility to suppression caused by the belief that it weakened the soldiers' practice of individual protection against mosquitoes. A very shrewd analysis of these factors was made by Major Maurice Seltzer, Malariaologist, Base Section No. 3 (chiefly Burma) in his June 1944 Malaria Report.⁶

"Though primarily designed as a means of relieving the hospitals of the load of malaria cases at the same time that battle casualties were pouring in, suppressive treatment for troops other than active combat troops appears to the undersigned to have been a mistake. It is felt that SOS troops at least have sufficient stability to make use of proper clothing, nets, and repellents to warrant the belief that a large percentage could have avoided malaria. Originally the undersigned felt that such discipline could not be secured, but having seen how continued pressure and backing by higher authority have secured better discipline and a drop in rates under all conditions, it is felt that SOS troops could have gotten along without atabrine. As it is the high break-through rate in some organizations makes it evident that too much reliance is being placed on the drug and that personal measures are being poorly enforced. Because the atabrine is keeping the rates down in other units where it is taken religiously, no official action can be taken at this time against these units if otherwise careless, as they will not show a high rate until the atabrine is suspended. Because of the continuing need of hospital beds, it is not desirable to interrupt the atabrine at present.

"The undersigned undertook an informal survey by personal questioning of officers and men of the state of malaria discipline existing in the 5307th Provisional Combat Unit while under combat conditions. Briefly, it might be stated that discipline was good during the first two months, especially as regards atabrine administration. About the only lag was in the use of repellents. Shortly after the interval stated above, concomitant with increasing fatigue, acquirement of other diseases, such as the dysenteries, morale began to deteriorate and malaria discipline suffered greatly. No attention was paid either to clothing, repellent, or the use of atabrine. As this process went on, the impression of the medical officers was that a large number of men deliberately exposed themselves or at least welcomed the incurrence of malaria infection.

"It is conceivable that in situations such as the above, no matter how elaborate and how perfect anti-malaria measures are, in the face of a command that no longer has the desire to stay well, little can be done. The incidence incurred by this combat unit accounts for a large percentage of the increase."

The belief that atabrine suppressive treatment is detrimental to malaria discipline and personal efforts to evade the mosquito persisted among many thoughtful and experienced malarialogists throughout the remainder of the Theater's course. Once the idea is brought home to the soldier that faithful taking of one tablet of atabrine a day will keep him from getting clinical attacks of fever he does become somewhat indifferent to the occasional mosquito bite that otherwise might cause him considerable concern. The threat of immediate illness is more real than the fear of future disability.

Unfortunately, atabrine propaganda, to be effective, must be dogmatic and forceful; emphasizing its good features and minimizing its shortcomings, its occasional failures and its undesirable side effects. This was done in the India-Burma Theater following the precedence established in the Southwest Pacific and promulgated in the official publications from The Surgeon General's Office during 1943 - 1945. It caused a certain amount of dissatisfaction among medical officers, especially thoughtful officers who questioned the intellectual honesty and scientific accuracy of such propaganda.

The Theater Surgeon's office was, at times, hard pressed to maintain its policy, as laid down in official publications,⁷ when presented by a growing mass of evidence as to the toxic effects of atabrine. The Surgeon took the stand that undesirable side effects did occur in a small percentage of those under continuous suppressive treatment and that such sensitive persons should be exempted from atabrine medication, the determination being made by the responsible medical officer. An example of this is given in an exchange of correspondence between the

Surgeon's office and various installations in the hyper-endemic zone where suppressive treatment was enforced.^{8, 9, 10}

At this point it may be well to consider the changes in atabrine policy established in early 1945 as a result of widespread acceptance of the results of the classical experiments reported from the American and Australian forces in the Southwest Pacific theaters of operation. For some reason or other, these studies were not well understood in India-Burma Theater until late in 1944, although the Theater Surgeon's decision (30 August 1944) to continue atabrine suppressive treatment in the forward areas after the termination of the transmission season, was apparently based upon a knowledge of the American-Australian work.⁴

"1. Repressive treatment of malaria by atabrine was started on 15 April for X and Y Forces in the Combat Zones. It has proved highly effective.

"2. a. Recent data indicates that this treatment, in addition to its repressive action, actually prevents the development of most cases of malignant malaria if treatment is continued for as much as four weeks after leaving the infected area.

b. In all but an extremely small percentage of individuals, prolonged taking of atabrine produces no ill effects.

c. If the repressive use of atabrine were discontinued after the close of this monsoon many thousands of cases of malaria would result. Based on results in the Southwest Pacific, where 3 American divisions were immobilized by malaria at one time, it would be necessary to bring in fresh troops who had not been exposed to malaria, in order to continue tactical operations during the dry months."

In December 1944 the Theater Surgeon, noting that atabrine discipline in the forward areas was not producing the desired control over clinical malaria, personally visited a large number of combat units and supporting elements then operating in the Bhamo-Lashio-Myitkyina area, at the same time explaining to line and medical officers the implications of the new theories from the Southwest Pacific. The sudden interest in atabrine as a suppressive drug shown at this time is further demonstrated by the fact that the Theater Surgeon's tour coincided with another whirlwind missionary tour conducted independently by Advance Section and employing two medical officers from the 18th General Hospital who had done much of the pioneer work with atabrine while stationed in the Fiji Islands in 1943 and early 1944 (Lt. Col. A. J. Schaffer, MC, and Captain Roger A. Lewis, MC).¹¹

ATABRINE SUPPRESSIVE AREA

It was inevitable, therefore, that the conference, called by the Surgeon in late December 1944 to overhaul Theater malaria control policies, should be dominated by a desire to emulate the extraordinary success of the 1944 malaria control programs of the Australian and American forces in the Southwest Pacific area.

The conference held in the Deputy Theater Surgeon's office 18 December to 20 December 1944 marked the turning point in the long battle for control of malaria in India-Burma Theater. It was composed of representatives from the Theater Surgeon's office and from Southeast Asia Command, Northern Combat Area Command, the ATC, the ASC-IBT and the QMC.¹²

As a result of this meeting Theater Circular No. 11 was published.¹³ This directive provided for the extension of compulsory atabrine suppressive treatment to include most of the hyperendemic malaria area of Burma, Assam and East Bengal (comprising about 60% of Theater strength during the period January-August 1945). So far as atabrine was concerned it represented a compromise between those who felt that suppressive treatment should be restricted to troops living continuously outside the "sanitized" areas and those who believed that there should be blanket suppressive treatment covering the entire Theater. Close liaison was kept with the Surgeons, ICD-ATC and USAAF-IBT in order to enlist their cooperation in making the program a success.

On 28 January 1945 Theater Circular No. 4 was published.⁷ It was educational in form and purpose, containing a summary of the new work from Southwest Pacific Area and emphasized the absolute necessity of obtaining 100% daily atabrine treatment. It was written with the advice and assistance of Colonel Earle Rice, MC, Malariaologist on duty with the Medical Advisory Division of Southeast Asia Command and Lieutenant Colonel A. J. Schaffer, MC, who had participated in the classical experiments with atabrine in Southwest Pacific Area in 1943 and 1944.^{14, 15}

By the middle of March 1945 the atabrine program was fully established in the areas designated.¹⁶ It was successful beyond all expectations thanks to a remarkable degree of command acceptance of responsibility for its execution. The seasonal winter fall of malaria rates continued on into the spring and summer when it was stabilized between 15-20/1000/annum. There was no summer or fall increase in malaria morbidity. Certain advance areas that had experienced rates as high as 1000/1000/annum in 1943 and 1944 reported rates below 20/1000/annum for the corresponding months of 1945. The highest incidence of malaria in 1945 occurred in the Base Section outside of the atabrine zone. Its rates differed little from those of previous years.

An interesting and unplanned-for side effect resulting from the control of malaria was a great decrease in the hospital population in the theater, especially in Advance and Intermediate Sections which

had always planned for a great influx of malaria during the months June-October. The bed capacity and personnel authorized for the Theater was partly based on an expected high malaria rate; with the elimination of this disease as a major cause of hospitalization, the Theater found itself with some excess in medical units and professional personnel. This factor plus the end of combat and the withdrawal of five Chinese divisions led to a serious morale problem among professional medical men for whom the work load became insufficient.

The relative importance of blanket atabrine suppressive treatment compared with the efficient environmental mosquito control program carried out by IBT malaria control detachments in bringing malaria under control will probably never be determined. It is, in a sense, unfortunate that the adoption of a broad program of atabrine suppressive treatment deprived the malaria engineers and entomologists of the satisfaction of demonstrating statistically the efficiency of their operations. That mosquito control was brought to an extraordinarily high level of effectiveness during 1945 cannot be denied. In the "Controlled" areas it was rare to find a mosquito during and following the monsoon season of 1945. The advent of DDT coincided with this conquest of the mosquito vector and undoubtedly played an important role in the control program. This applies likewise to a third important factor, namely, air spraying of DDT, which was pushed vigorously from early March to November 1945.

Irrespective of the relative effects of these factors, there remains one other factor that undoubtedly had a major influence on sick rates in IBT during the last 9 months of 1945, namely, the cessation of hostilities. Except for traffic operation along the Stilwell Road and air support of British forces in Central Burma, most of the American forces in the Theater quickly returned to a tranquil and orderly garrison life in well policed and relatively mosquito free areas soon after the capture of Lashio in March.

On the debit side of the ledger must be recorded a relatively high incidence of toxic reaction to atabrine. Of the various reactions held to be due to atabrine intolerance, the syndrome known as Atypical Lichen Planus was the most important in IBT. The transient gastro-intestinal upsets sometimes seen in the first week or two of suppressive treatment caused no serious concern. Likewise "atabrine psychosis" was of lesser importance.

The first evidence of the toxic effects of atabrine seems to have been picked up by the astute and observant clinicians of the 20th General Hospital group in late 1943. Abnormal mental behavior was noted in malaria patients undergoing treatment with atabrine and "atabrine psychosis" began to appear in the reports as a side effect of clinical treatment with this drug. (See Neuropsychiatric History of IBT, Lt. Col. Mays).

Interest in skin lesions associated with atabrine treatment was first initiated by receipt of a letter from The Surgeon General, subject: "Request for Information on occurrence of an unusual skin disease," 30 October 1944.¹⁷ A quick survey in response to this letter uncovered 3 cases at the 20th General Hospital¹⁸ and one possible case, later classified as neurodermatitis, at the 234th General Hospital.¹⁹ These two hospitals situated within the atabrine zone, later defined in Theater Circular No. 11, became centers for the study of all skin reactions due to atabrine. Major Clarence Livingood, MC, Dermatologist, 20th General Hospital, was the pioneer in the field and performed a valuable service by training other medical officers to identify the new disorder.

By March 13, 1945 the Theater Surgeon was able to report to The Surgeon General that 12 cases had been observed and described.²⁰ On 19 March, Major Livingood reported 6 additional cases²¹ and outlined plans for continued study by Major James Flood, MC, and Major Thomas Machella, both of the 20th General Hospital. The possible role of sensitization reaction to certain Burma jungle trees (tree sap dermatitis) was discussed by the 20th General Hospital.²² At the same time a request from the 20th General Hospital for exemption from AST was rejected by the Theater Surgeon.²³ On 14 April in a letter to The Surgeon General, the Theater Surgeon, in forwarding various reports on Atypical Lichen Planus, requested that The Surgeon General inform him of the present status of the problem in other theaters.²⁴ The Surgeon General summarized the War Department opinion as of 7 May 1945²⁵ in the following words:

"6. The following is a summary of opinion of this office at the present time regarding use of atabrine for suppression of malaria:

a. The military value of atabrine in suppressing vivax malaria and preventing falciparum malaria far outweighs untoward effects which may result from taking the drug.

b. Suppressive dosages greater than 0.7 gram per week should not be employed routinely.

c. When individuals react with definite sensitivity to atabrine or acquire certain dermatological conditions, including atypical lichen planus, unexplained chronic eczematoid dermatoses, unexplained toxic erythematous eruptions and exfoliative dermatitis, atabrine suppressive medication should be promptly discontinued. Quinine is available for substitution in accordance with par. 2, TB MED 65, July 1944.

d. Caution should be exercised in attributing disease conditions to use of atabrine suppressive medication until careful and complete studies have been made over a period of time to establish such relationship. Even if a relationship

is established, its significance relative to the military value of atabrine should be evaluated before concluding that the program for atabrine suppression is unjustified. Detailed information and instructions in regard to management of individuals for whom atabrine is considered to be contraindicated should be disseminated to medical officers, but the use of informal methods rather than published directives is desirable. Unwarranted rumors as to possible ill effects from atabrine seriously interfere with discipline in taking the drug."

During July and August 1945 an increasing number of cases were reported from Burma and Assam and summaries of the experience to 1 July were prepared by the 20th General Hospital and the 234th General Hospital.^{26, 27} On 21 August the Theater Surgeon republished The Surgeon General's letter of 19 July, subject: "Reaction to Atabrine," and directed that all cases be treated in one of the three remaining general hospitals, a practice already in general effect.²⁸ This was implemented in the field by oral and written directives.²⁹

Two other interesting cutaneous syndromes attributed to atabrine intolerance were described by the dermatologist at the 20th General Hospital and the 69th General Hospital. Captain Harvey Blank, MC, on 10 May 1945, submitted a paper on 12 cases of "Urticaria-like Syndrome Caused by Sensitivity to Atabrine."³⁰ On 18 March 1945 Major Livingood of the 20th General Hospital reported 18 cases of a "Hypohidrosis Syndrome"³¹ also possibly due to atabrine sensitivity. These papers were forwarded to The Surgeon General's Office as received.

Attempts to determine the true incidence of suppressed malaria in the troops living in the advanced sections were not particularly successful although Major Machella made an earnest effort to solve this problem by a field experiment with highly exposed troops.

Following discontinuance of AST in the 20th General Hospital in late August 1945 two other well policed medical installations were also exempted on 2 September, namely, the 234th General Hospital and the 9th Medical Laboratory.

With the breakup of the Theater following V-J Day emphasis was placed on the evacuation of the "forward areas" of Assam and Burma. Because of the excellent state of mosquito control in these areas and because of the growing alarm over the rising incidence of Atypical Lichen Planus, the Commanding General of the combined Sections on 30 September requested that atabrine suppressive treatment be abandoned.³² This request was backed up by medical opinion dealing with the harmful effects of atabrine on liver and skin.

After an exchange of correspondence between Theater Headquarters and the new Intermediate Section, the AST program was modified considerably.³³ The main change was to put suppressive treatment on an optional basis in the large well controlled troop concentration areas. This was agreeable to all parties and appeared to be working considerably well up to 4 December except for a mild increase of recurrent malaria in troops enroute to Ports of Embarkation.

Exact statistical data on the occurrence of Atypical Lichen Planus in India-Burma Theater is not available. However, to the middle of November there had been dispositioned to the Zone of Interior approximately 200 cases during 1945. It is estimated that about 30% of all cases returned to duty. On this assumption the total number of cases should be in the vicinity of 260. However, it may be noted that it was the belief of the 20th General Hospital investigators that not all cases were recognized and reported. If this is true the total may eventually run up to 300 or more. The distribution of dispositions by month is shown in the chart below. Since most of the cases had had long hospitalization previous to disposition, a chart of the true monthly incidence would show a distinct shift to the left of the blocks of the graph.

A summary of the experience with Atypical Lichen Planus at the 20th General Hospital is enclosed.³⁴ Other data from the 234th and 142nd General Hospitals are also appended.^{35, 36}

In retrospect it would appear that the Theater policy regarding Atabrine Suppressive Treatment was probably too rigid and that more serious attention should have been given to the increasing incidence of skin reactions. The fact that the War Department was very conservative in accepting atabrine as the cause of these reactions plus the fact that the British claimed to have seen none of these reactions in their much larger forces in India, also subjected to the same drug, were the basic reasons for the Surgeon's conservatism in accepting the thesis propounded by the medical investigators in the Advance areas.

It is hoped that this vexing question can be soon settled conclusively by an official pronouncement by the War Department so that in the future a more rational use of atabrine may be made in military operations.

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11. Malaria Commission

In August 1944 through arrangements made between the Surgeon's Office and the Professional Division, SGO, a group of three Medical Corps and one Sanitary Corps officers arrived in India for the purpose of instituting research in malaria.^{1,2}

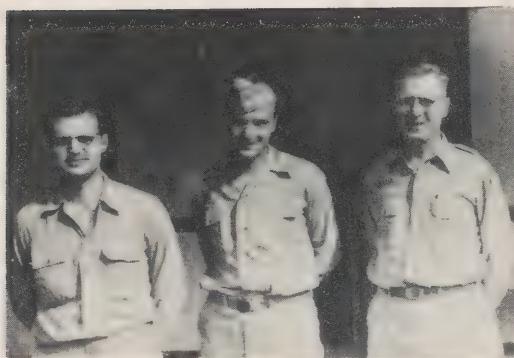
The broad objectives of this group were outlined in a letter to the Surgeon from Major (then Captain) Ellery Becker, SnC, head of the Commission on 14 October.³ They dealt chiefly with chemical problems connected with atabrine therapy.

Unfortunately through lack of coordination the Commission was broken up on arrival, the three Medical Corps officers being sent to routine duty at various stations and Major Becker to the 9th Medical Laboratory for duty. The Malaria Commission was not established as such until early January 1945 at which time, through the courtesy of Brigadier General (then Colonel) Isidor S. Ravidin, Commanding Officer, it was given working space and facilities at the 20th General Hospital at Ledo, Assam.^{4, 5, 6}

The Commission as finally constituted was made up of Major Becker and two enlisted medical technicians. It was carried as a part of Theater "overhead" personnel and was assigned to the T/O of the Theater Surgeon's Office. Photofluorometers were provided for atabrine determination on body fluids and a series of studies started on personnel undergoing atabrine treatment (suppressive and therapeutic). One of Major Becker's chief aims was to develop a simple urinary chemical test that would indicate the concentration of plasma atabrine by using a technique developed by the British and described in Interim Report No. 27 of the Malaria Research Unit, November 1944. This was based on the correlation that had been shown to exist between plasma atabrine levels and the titratable acidity of the urine. A paper describing this research was forwarded to The Surgeon General on 12 September 1945.⁷

Employing these and other more conventional techniques, Major Becker surveyed groups of soldiers who were on continuous atabrine suppressive treatment. His work was well received and proved to be of value to commanding officers in enforcing the atabrine program.^{8, 9}

PERSONNEL OF THE MALARIA COMMISSION



(Left to right) Tec 5 Craighill S. Burks,
Tec 5 Edwin Kaleita, Major E. R. Becker

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2. Radio CRA 5671, 13 June 1944, CBI to SGO.
3. Ltr, 9th Medical Laboratory, 14 October 1944, "Problems for Investigation by the Malaria Commission."
4. Ltr, Hqs SOS IBT to CO, 20th General Hospital, 16 December 1944.
5. Ltr, Hqs 20th General Hospital to Assistant Surgeon SOS IBT, 22 December 1944.
6. Memorandum, Surgeon USF IBT, 29 December 1944, "Malaria Commission."
7. Manuscript, "A Combined Field and Laboratory Process for the Estimation of Plasma Atabrine Levels in Field Troops from Single Samples of Urine," by Major Ellery Becker, Captain John A. Carter, T/5 Craighill Burks, T/5 Edwin Kaleita.
8. Report, "Effectiveness of the Suppressive Atabrine Program in Advance Section, IBT as indicated by Plasma Atabrine Levels."
9. Ltr, Malaria Commission, 10 June 1945, "Atabrine Tests on various Military Organizations made 17-25 May in Advance Section, SOS, USF, IBT.

TABLE IV
MALARIA
 THEATER RATE PER/1000/YEAR

WEEK	MONTH	1943 Rate	1944 Rate	1945 Rate
		Per 1000/A	Per 1000/A	Per 1000/A
1	January	132	74	98
2		97	95	65
3		99	59	69
4		75	70	66
5		70	62	53
6		80	77	47
7	February	74	72	43
8		89	52	40
9		77	56	28
10		54	50	25
11		47	77	19
12		58	72	21
13	March	73	66	17
14		43	68	17
15		62	80	17
16		72	86	18
17		95	142	17
18		96	80	13
19	April	82	107	12
20		85	111	16
21		109	178	13
22		135	182	18
23		167	165	19
24		212	174	17
25	May	309	208	14
26		364	217	20
27		309	198	19
28		361	296	17
29		240	281	17
30		231	272	19
31	June	321	311	15
32		358	274	13
33		317	294	15
34		337	231	15
35		276	250	12
36		313	244	12
37	July	295	209	16
38		269	195	13

MALARIA
Theater Rate Per 1000/V.

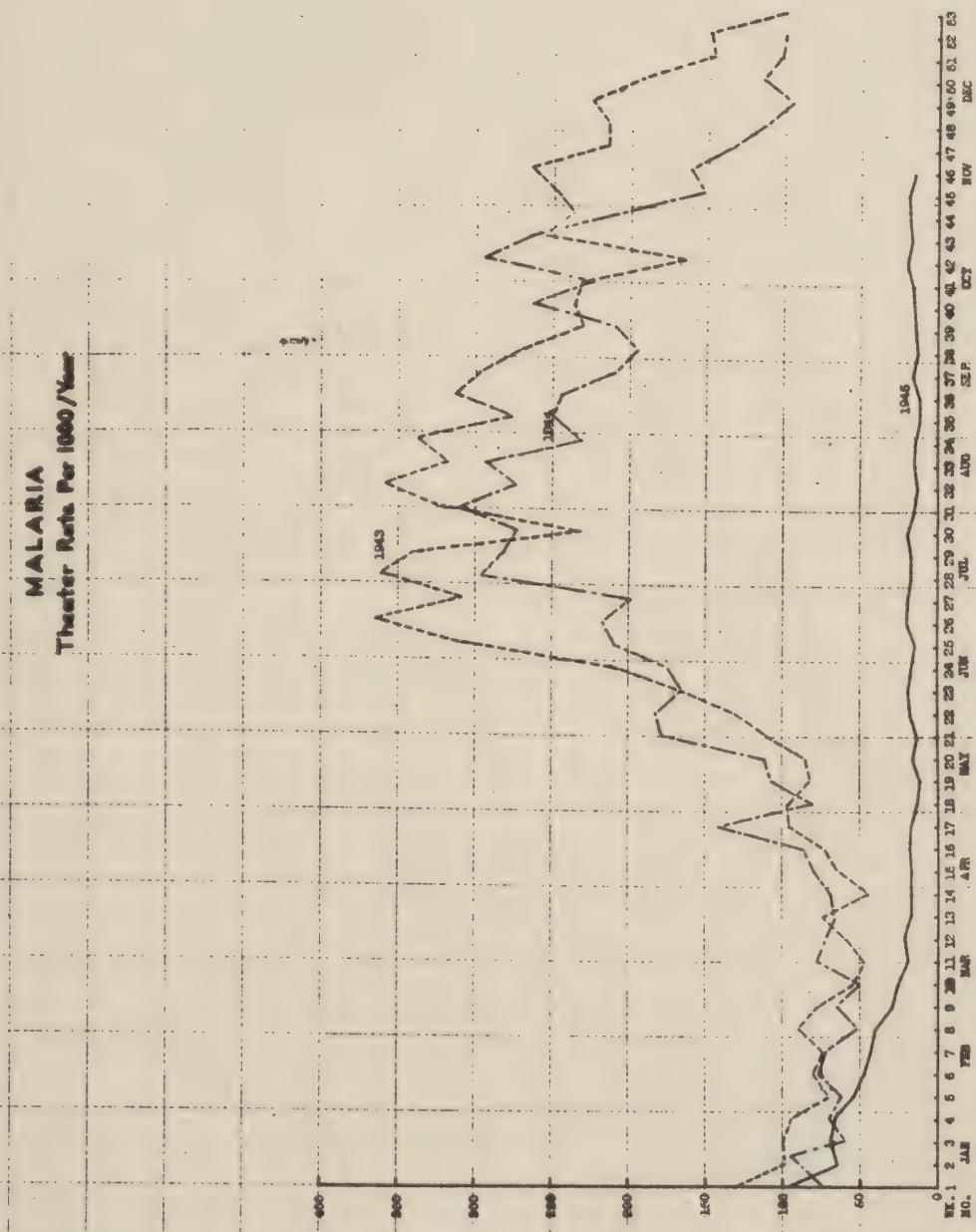


CHART II

TABLE IV

M A L A R I A

THEATER RATE PER/1000/YEAR

WEEK	MONTH	1943 Rate	1944 Rate	1945 Rate
		Per 1000/A	Per 1000/A	Per 1000/A
39		231	220	14
40	October	236	246	15
41		331	224	16
42		165	249	20
43		256	262	17
44		237	208	17
45	November	248	152	18
46		264	162	15
47		215	133	
48		215	112	
49	December	225	95	
50		192	115	
51		147	102	
52		194	100	
53		101		

TABLE V

MALARIA

BASE SECTION RATE / 1000 / YEAR

WEEK	MONTH	1944 Rate	1945 Rate
		Rate/1000/Year	Rate/1000/Year
1		58	49
2		49	36
3	January	34	33
4		27	44
5		89	38
6	February	38	27
7		33	25
8		94	31
9		20	21
10	March	23	25
11		32	26
12		33	25
13		31	24
14	April	32	20
15		67	20
16		64	26
17		80	20
18		35	17
19	May	57	13
20		57	18
21		98	15
22		89	23
23	June	69	24
24		71	21
25		67	18
26		79	30
27	July	90	26
28		90	18
29		106	22
30		89	25
31		135	20
32	August	102	17
33		157	21
34		109	18
35		89	20
36	September	123	16
37		101	24
38		92	23

MALARIA
Base Section Rate / 1000/Year

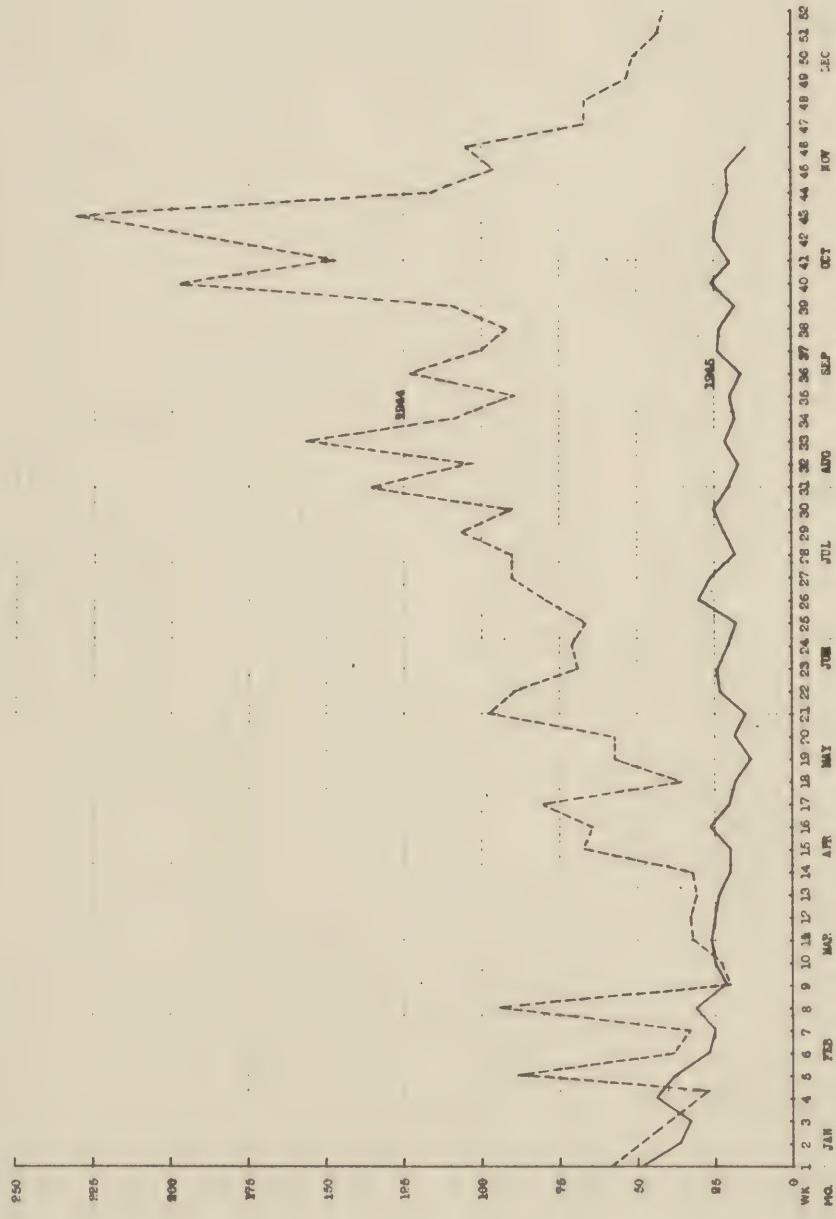


CHART III

TABLE V
M A L A R I A
 BASE SECTION RATE / 1000 / YEAR

WEEK	MONTH	1944 Rate	1945 Rate
		Rate /1000/Year	Rate /1000/Year
39		109	18
40	October	197	26
41		146	20
42		186	25
43		231	24
44		116	18
45	November	95	21
46		105	15
47		67	
48		67	
49	December	53	
50		51	
51		43	
52		36	

TABLE VI

M A L A R I A

INTERMEDIATE SECTION RATE/1000/YEAR

WEEK	MONTH	1944 Rate	1945 Rate
		Per 1000/A	Per 1000/A
1		180	103
2		118	71
3	January	20	77
4		20	78
5		51	63
6	February	36	54
7		40	61
8		58	41
9		52	28
10	March	52	17
11		70	6
12		63	11
13		78	8
14	April	80	5
15		120	6
16		97	4
17		93	5
18		115	5
19	May	159	3
20		182	5
21		276	11
22		279	3
23	June	294	4
24		297	5
25		419	5
26		243	8
27	July	228	8
28		261	10
29		271	10
30		248	14
31		255	1
32	August	262	3
33		310	5
34		258	0
35		235	7
36	September	277	8
37		179	7
38		217	3

MALARIA
Internedisch Sodin Rate/1000/Year

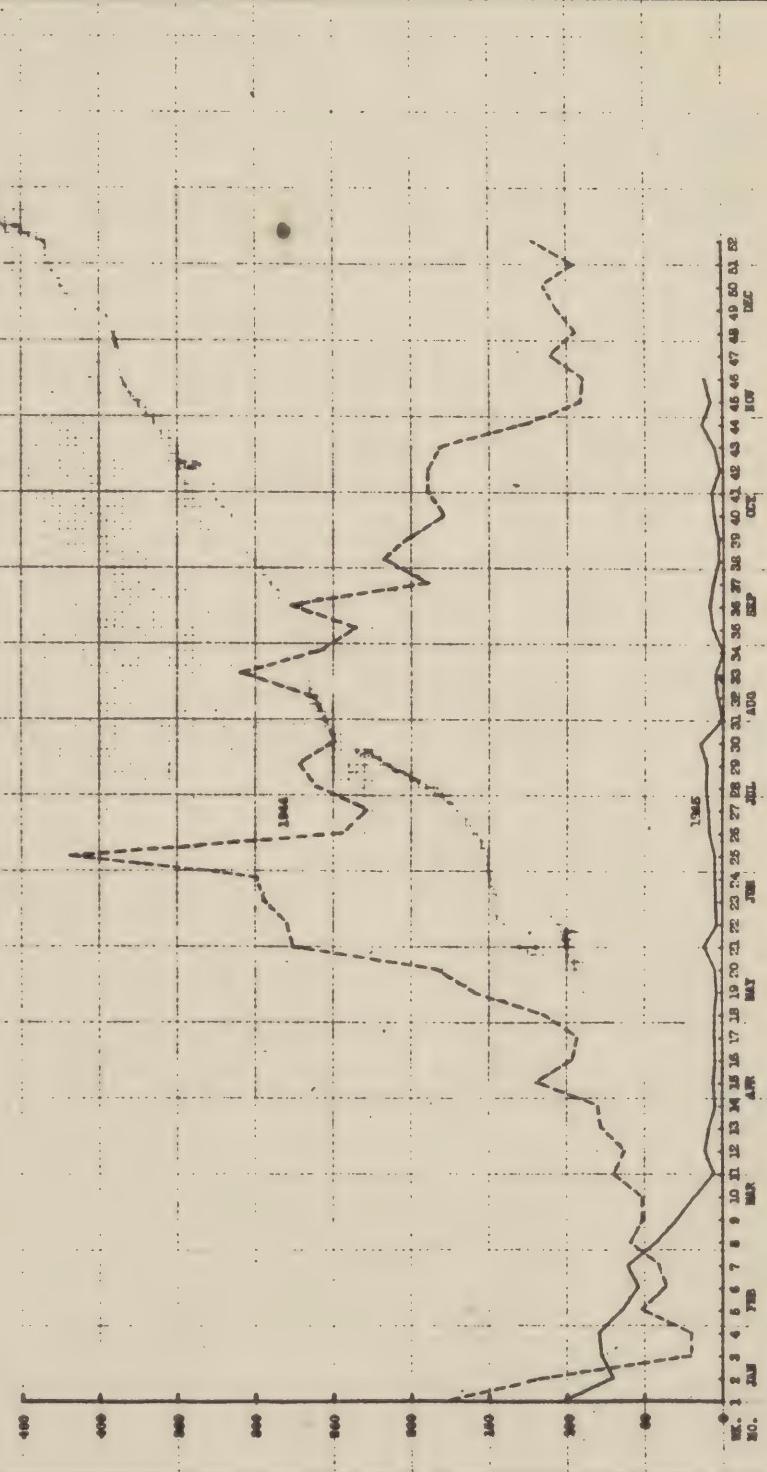


CHART IV

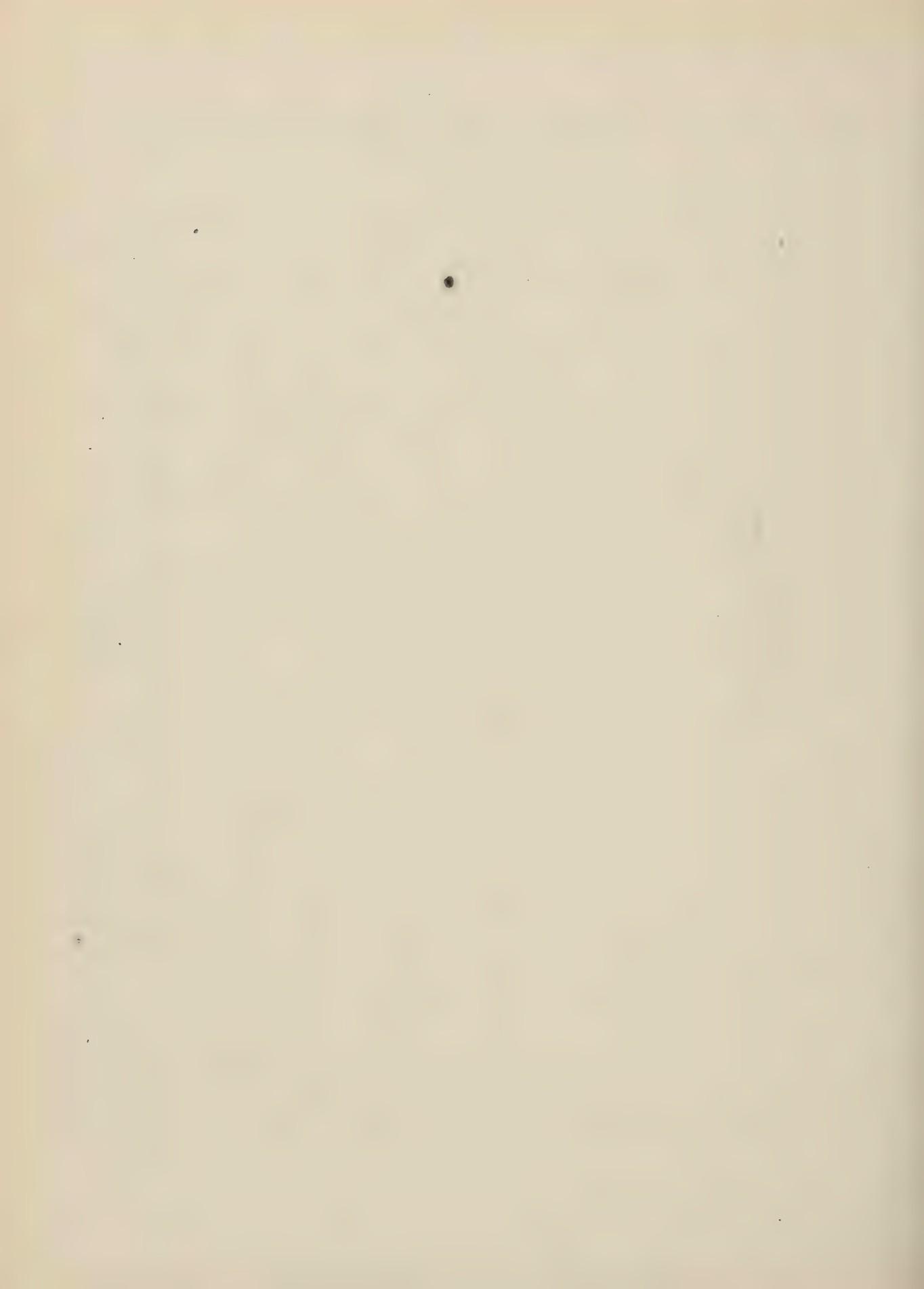


TABLE VI
MALARIA
INTERMEDIATE SECTION RATE/1000/YEAR

WEEK	MONTH	1944 Rate	1945 Rate
		Per 1000/A	Per 1000/A
39		199	3
40	October	179	6
41		189	7
42		189	2
43		182	5
44		127	13
45	November	92	8
46		90	12
47		111	
48		93	
49	December	106	
50		115	
51		95	
52		121	

TABLE VII

MALARIA INCIDENCEADVANCE SECTION, IBT

WEEK	MONTH	1943 Rate	1944 Rate	1945 Rate
		Per 1000/A	Per 1000/A	Per 1000/A
1		235	289	245
2		106	290	175
3	January	159	203	207
4		99.6	268	143
5		5.0	189	92
6		98	211	100
7		87	208	45
8	February	66	150	32
9		21	166	22
10		39	150	8
11	March	40	203	16
12		0	214	8
13		0	197	8
14		50	167	12
15		70	155	7
16	April	111	195	20
17		90	184	15
18		131	185	23
19	May	91	178	23
20		72	219	8
21		133	362	23
22		284	350	34
23	June	313	341	32
24		674	353	19
25		996	432	18
26		798	579	16
27		904	502	27
28	July	834	1018	19
29		535	861	19
30		700	792	13
31		1186	865	17
32	August	994	755	15
33		1044	668	28
34		672	601	9
35		851	595	11
36	September	667	467	7
37		743	466	7
38		738	392	3

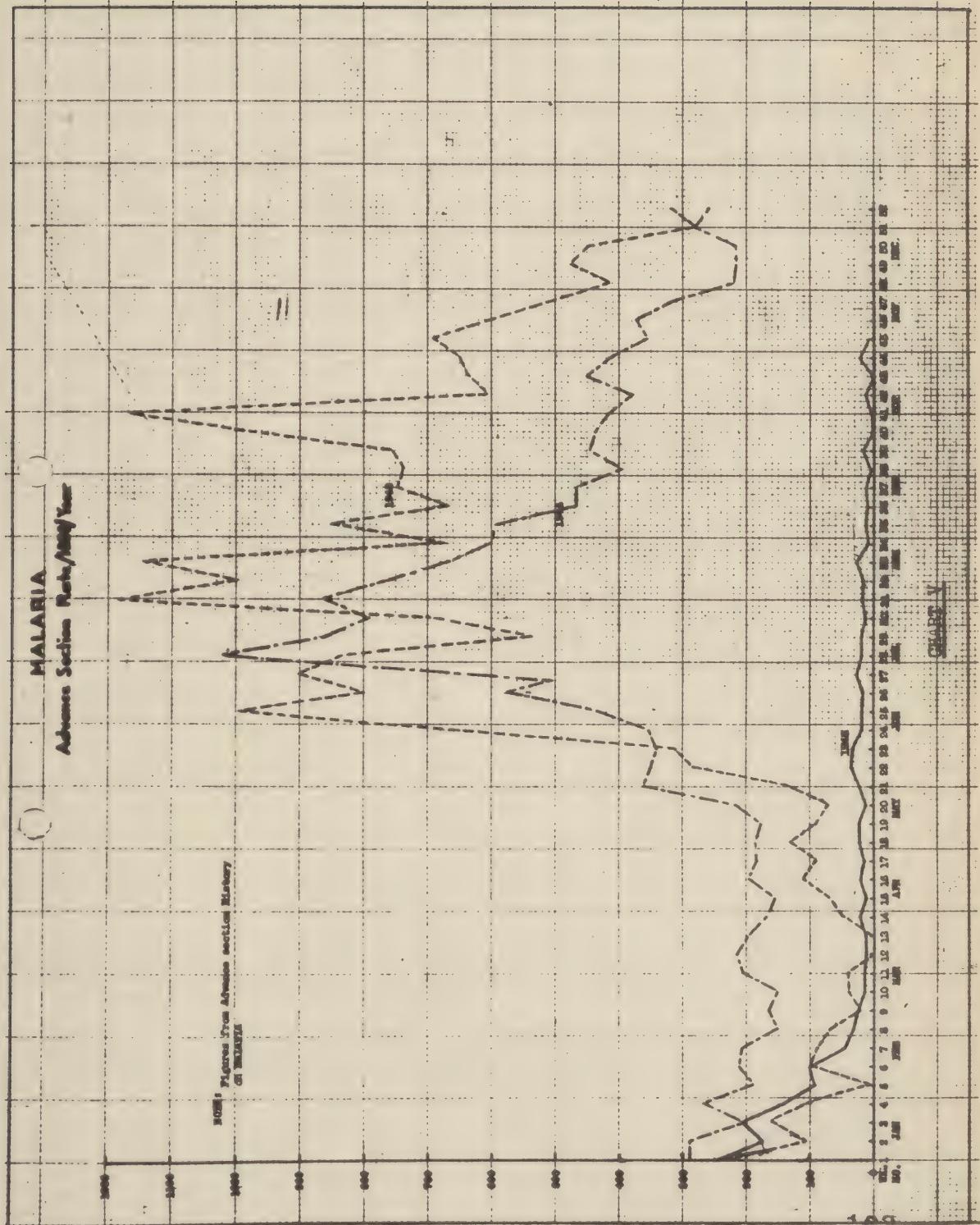


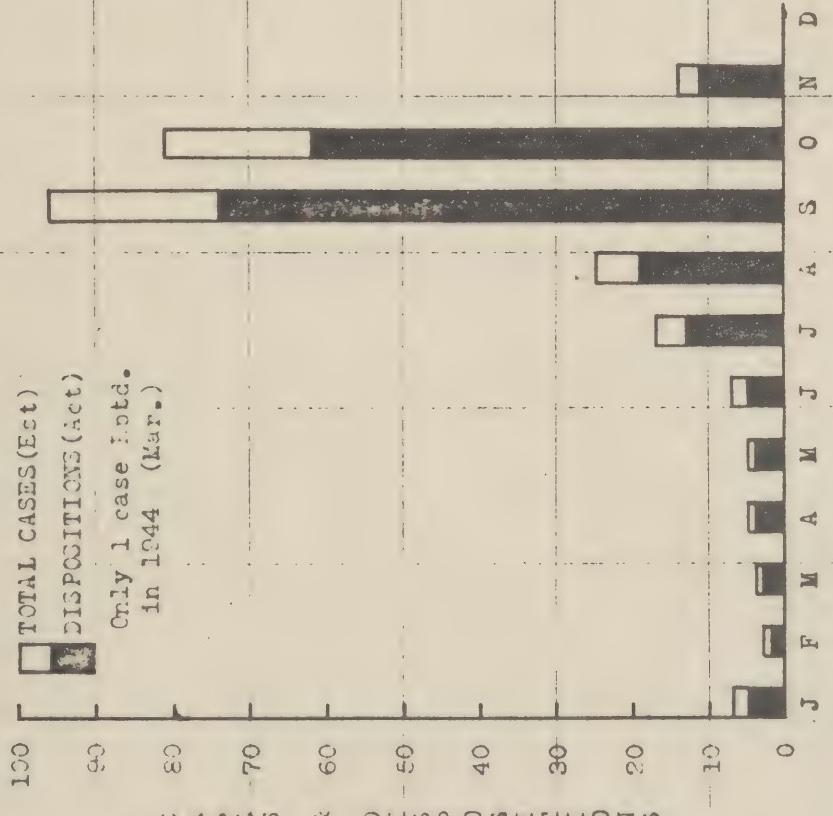
TABLE VII

MALARIA INCIDENCEADVANCE SECTION, IBT

WEEK	MONTH	1943 Rate	1944 Rate	1945 Rate
		Per 1000/A	Per 1000/A	Per 1000/A
39		758	444	16
40		994	438	
41	October	1166	416	1
42		607	378	12
43		635	450	21
44		650	413	8
45	November	691	356	
46		609	372	
47		519	314	
48		414	220	
49	December	473	216	
50		446	216	
51		280	280	
52		318	257	

LICHEN PLANUS

1945



CROSS SECTION 10 X 10
TRACE MARK

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XIII: CONTROL OF VENEREAL DISEASES

1. Introduction

India has long been known to harbor much venereal disease. Accurate statistics as to the prevalence of these infections are not available, such figures as can be obtained having been collected from groups unrepresentative of the whole population. It is known, however, that gonorrhea, syphilis, chancroid, lympho-granuloma venereum and granuloma inguinale are widespread and that these infections are probably more frequent among the lower classes.

There are numerous barriers to the control and treatment of the venereal diseases. The general level of education of the population is low, the vast majority being able neither to read nor write, making dissemination of information exceedingly difficult. Religious beliefs all too often prevent or hinder control measures. Prostitution is common in all parts of the country; in the larger cities it is a well organized profession maintaining an army of procurers. For the most part prostitutes live in filthy surroundings but there are always a few houses which cater to the moneyed classes operating in luxurious establishments with all "sanitary" installations. These brothels were generally out of the price range available to the soldier who therefore patronized the inexpensive prostitute in her hole-in-the-wall room or perhaps in an open field. These women were nearly all infected and in many cases had two or more of the venereal infections.¹

No particular effort was made by law enforcement authorities to suppress the prostitution which flourished so openly. Some of the women were reputed to be examined occasionally and kept under public supervision. They carried cards purporting to show them free of infection. Some effort was being made by public health officials to ameliorate the situation by bringing knowledge to the people and providing free treatment but the magnitude of the problem was so great and funds so short that a bare beginning was all that has been accomplished.

2. Control Program.

No organized plan for venereal disease control existed when the Theater was activated. A few prophylaxis stations were established where troops were located but the men were not sufficiently impressed with the necessity of using them. Venereal disease rates were therefore high and loss of time excessive.

To combat the situation a Venereal Disease Control Officer was appointed on the staff of the Surgeon, Services of Supply, charged with the responsibility of initiating and continuing measures to keep venereal rates down.² Before he had opportunity to take much action a consultant arrived from Washington to investigate the situation and recommend control measures. He reported that venereal disease among American troops was a cause of concern at only three stations. However, at these points were concentrated the great bulk of troops in the Theater at that time. Interest in control measures was expressed by both medical and line officers wherever he went but at few, if any, places were adequate measures in force.

The consultant drew up a program for control of venereal disease, the basic principles of which have been followed throughout the operation of the Theater. He recommended, in order of importance, the provision of adequate recreational facilities varied to meet the special needs of different groups to include sports, games, books and movies; education, by means of lectures, demonstrations, motion pictures and posters, to include instruction concerning the infectiveness and clinical course of the diseases; prevention by the use of condoms and prompt prophylaxis and the need for early treatment in case one of the diseases is contracted; ready availability of chemical and mechanical prophylactics to all soldiers; the finding of sources of infection by venereal disease control officers so that appropriate measures could be taken, including placing of areas out-of-bounds; the maintenance of as few records as possible consistent with securing statistics and other necessary information; and the insistence that commanding officers assume their full responsibility for venereal disease control in their own organizations.³

The report outlined the problem in the large population centers and the general lines of attack upon it. At the time, there were but few troops in rural areas where the problems were somewhat different. The excessively high rates among Negroes, as compared with Whites, was not discussed, a problem which had already been noted and which was to continue throughout the history of the Theater.

In following up the recommendations of the consultant, a letter was sent by the Theater Commander in April 1943 to major commanders outlining to them the seriousness of the problem and the measures to be taken to correct it. The methods already suggested were included with particular stress being laid on the responsibility of commanding officers, who were advised that explanations for continued high rates would be required. Continuous vigorous action was called for. By means of this letter an integrated Theater policy was established which could be supplemented in the future as occasion required.⁴

The continued action called for in the first letter was maintained from the Theater level by the periodic issuance of letters and circulars, inspections, requirement that VD control activities be discussed in the monthly sanitary reports, and by letters through command channels requiring explanations for high rates. These letters were perhaps the most important single method employed to ensure that effective programs were in force and that vigorous continuous action was being taken. Finally as a corollary to these command letters commendations were sent to those organizations having no venereal disease for periods of three months.⁵

3. Recreation

Wholesome recreation is probably the greatest single deterrent to sexual contacts, acting as it does by preventing boredom and keeping men in camp and out of brothel areas. Its importance was apparently not realized at first. In the directives sent to the field the need for recreation was generally mentioned but the stress was laid on other measures of control. Only gradually was a recreational program sufficiently varied to meet the tastes of every man developed. This was in part, however, due to the early lack of supplies as well as failure to recognize the need for entertainment.

Each organization brought with it some athletic equipment and a few books. Some had radios. Upon arrival funds with which to equip a day room were provided. As supplies improved, worn out athletic equipment was replaced, more books furnished, radios distributed, and games and small musical instruments provided. Limited funds for the purchase of equipment on the open market were made available but the civilian supply of such articles was always low.

Full use of the equipment was not made at first. With increasing awareness of the necessity for recreation, regular entertainment programs began to be sponsored, athletics, both "intramural" and league, were organized and participation encouraged. Motion pictures were shown three times a week in many places. Red Cross clubs increased in number and extended their activities, particularly in the larger cities where their need was greatest. USO shows came over in great numbers. A chain of American operated radio stations was built which broadcast the more interesting programs from home. Handicraft sets of various types became available and satisfied the creative urges of many of the men.⁶

4. Education

A continuous educational program making full use of every means of instruction available was stressed in every directive. It was expected that lectures would be given but aids were to be used whenever possible. Motion pictures were made readily available, locally reproduced posters supplied at first were later supplemented by those from the United States, and small VD booklets and maps showing out-of-bounds areas prophylaxis stations and authorized amusement places were widely distributed. The prominent display of posters and maps on bulletin boards, in day rooms and elsewhere served as daily reminders of the seriousness of venereal infection and how to avoid it.⁷

The educational program was begun at the time troops arrived in India. Port Commanders generally required that lectures be given on the exceedingly high venereal disease rates in Indian prostitutes and distributed information on out-of-bounds areas, the local control measures in effect, authorized amusement places, and the location of permanent prophylaxis stations. Temporary stations were set up on piers and the incoming ships to take care of the expected increased load. Probably the men received some conditioning by these provisions at the start of their service in India.⁸

Education was then continued employing the methods discussed above. The frequency of lectures, motion pictures and other formal methods of instruction was dependent upon the local problems. Instruction was given more often where rates were high or increased exposure might be anticipated. Negro troops, particularly, needed many reminders. Men going on furlough or to rest camps were briefed before leaving.

It was also necessary to educate officers, both commanders and medical, as to the importance of employing every possible measure of control and in methods of instruction which would be effective. The first of these two objectives was to some extent accomplished by circulars and directives published periodically and by the disciplinary letters sent to commanders whenever the venereal disease rates became too high. The second objective, improvement in teaching methods, was attacked by varying the type of teaching to fit the needs of the local situation. In Colored organizations, non-commissioned officers were appointed in each company as assistants to help with VD control and instruction. Colored medical officers, when available, were assigned to venereal disease control duty with Colored troops; Colored chaplains were utilized to the fullest extent possible. By

receiving instruction from members of their own race and through appeals to racial pride it was believed that a greater reduction in rates could be accomplished than by more conventional methods.⁹

One interesting suggestion by a Colored medical officer for the control of venereal disease in Negro troops was never given a trial. He believed that "the sales aspect of the program does not reach the Colored soldier in such a manner as to catch and retain his interest." He had noted that the Colored soldiers are extremely interested in "jive talk," a semi-secret language known only to themselves. They are anxious to enlarge their "jive" vocabularies. He suggested the development of a venereal disease booklet written in jive and which would include a glossary of jive terms. The book would be retained by the Colored soldier and successive editions eagerly awaited. Testimonials on clean living by famous Negro athletes would be added.¹⁰

5. Prophylaxis

That prompt chemical prophylaxis will prevent venereal infections has long been recognized. For this reason the establishment of prophylaxis stations wherever troops were located was one of the first steps taken in the control of venereal disease in the Theater. It quickly became evident, however, that many soldiers were failing to make use of the facilities provided. Various methods were devised to increase the numbers reached, including education, the opening of more stations adjacent to the sites where exposure was apt to occur, the issuance of free mechanical and chemical kits, forcible prophylaxis for those returning to camp drunk, late or found in out-of-bounds areas, and a check-pass system whereby all men were questioned as to exposure on return to camp. If a man in the last group admitted contact he was given a prophylaxis.¹¹

No figures are available as to the number of men exposed in comparison to those who took prophylaxis. Occasionally officers expressed the opinion that stations were used regularly but probably too long after exposure in some cases. It is known that many thousands of treatments were given. It is believed that the campaign carried on was reasonably successful in securing its objective particularly as the venereal disease rates have been comparatively low.

During the war the routine use of sulfathiazole prophylaxis was directed by the War Department. It caused a great deal of discussion and some opposition among medical officers. Those opposed to the administration of the drug pointed out that a man might expose

himself repeatedly in a day or, daily over a period of time, and render himself liable to toxic effects of the drug from excessive dosage, particularly during the hot season. This was recognized as a legitimate criticism, and in most instances instructions were given to attendants to exercise caution in giving the drug. Orders that it be given by the station attendant only and never issued to the soldier to take himself were necessary to insure proper dosage.¹² The Theater Surgeon never pushed sulfathiazole prophylaxis and left section surgeons full power to use their discretion in prescribing such treatment.

6. Sources of Infection

The location of sources of infection was undertaken in this Theater primarily in order that areas harboring prostitutes in large numbers could be declared out-of-bounds. It was not anticipated that reporting of cases to civilian authorities would have much effect on the overall situation as there is too much venereal disease in India and public health measures for its control, including treatment, were hopelessly inadequate and could only scratch the surface of the problem.

Printed or mimeographed forms were used to collect the necessary data.¹³ From a study of these forms it soon became evident that a large part of the venereal disease was arising in the more populous areas of India, particularly the larger cities. There were higher venereal disease rates in these areas as well as greater opportunities for exposures. Known brothel areas had been declared out-of-bounds; new ones were discovered periodically by this means and added to the list of off-limit areas. However, the sources of infection were so ubiquitous, the procurers so adept at seeking out customers, and some of the men were so intent on sexual gratification that the out-of-bounds system was never very successful in preventing exposure.

One of the common sources of infection impossible to control completely was the native "gharry." These horse drawn vehicles are to be found in every city and are often a convenient and sometimes the only means of civilian transportation available. The drivers sometimes act as pimps or procurers, and their conveyances, impossible as it might appear, provided the facilities for the sexual act. Partial control was attempted in Karachi and Calcutta by declaring them out-of-bounds after sunset.

While control could be exercised over recognized houses of prostitution or even whole towns by placing them out-of-bounds, it was not possible to prevent contacts between soldiers and the casual prostitute who operated by herself, either in the cities or in the fields

in rural areas. Camp followers were prevalent in all parts of India and Burma and, in some areas, they became so numerous as to assume the proportions of organized prostitution. Much of the venereal infection, particularly in the late days of the Theater, was traceable to these casual operators.¹⁴

Many of the troops arriving in India were landed upon the west coast of the country in Bombay. This necessitated a long trip across the country to their ultimate destination. Slow trains, making many stops of varying duration, were the customary conveyances. Opportunities for sex contacts were frequent. At Parbatipur in Base Section, a railroad change from broad to meter gauge was necessary. Coincident with the changeover was a long delay. Prostitutes took full advantage of the men, bored by an already long trip, to ply their trade. Control was finally effected by placing the entire town, except for the railroad yards, out-of-bounds. Following this action the number of cases of venereal disease arising there dropped to near zero. The same method was followed later with equal success all along the railroads.¹⁵

7. Records

In the case of the venereal diseases the maintenance of as few records as possible coincident with the accumulation of necessary statistics is desirable. Particularly the compiling of names in prophylactic stations serves no useful purpose and may defeat the object of the stations. Such practices were found to be in operation in some instances. They were discontinued early in 1944 when no longer required by Army Regulations.

The compilation and reporting of venereal disease cases was troublesome especially in the early days of the Theater. Venereal disease rates as calculated from the Statistical Health Reports (Forms 86ab) and from VD reports did not agree, the latter consistently being lower than the former. This apparently resulted from duplicate reporting by dispensaries and hospitals and failure to distinguish between "new," "old," and "long" cases. Circulars, memoranda and letters giving detailed instructions for preparation of all reports had to be issued at frequent intervals. While reporting became more accurate there were always some cases of error, the monthly VD reports continuing to be the more accurate. It was from these forms that statistics have been compiled.¹⁶

8. Discipline

A high state of discipline in an organization does much to control venereal disease. Realized early, this fact was brought out in each directive sent to commanders in the field. They were instructed to use every means to develop and maintain discipline within their organizations. Venereal disease rates were held to be in part an index of the efficiency of a commanding officer and a measure of the discipline maintained within his organization.

There will always be a few recalcitrants as well as individuals who for various reasons will forget what they have learned. Various measures were employed to insure compliance with orders. Out-of-bounds areas were patrolled by military police who picked up offenders and turned them in for appropriate disciplinary action. Such action tended to become more severe as time passed and it was learned that stronger measures were required. Compulsory prophylaxis and the check-pass system have been discussed above. Chronic offenders were refused passes and in a few cases, where rates remained high, whole organizations were restricted to their camp areas for varying periods of time. Curfew and bed-check systems were used occasionally.¹⁷

9. Rest Camps

In an effort to relieve men of the tedium of life in the hot tropical climate of India and to give them periods of rest and relaxation there were established a series of rest camps. The locations chosen for the camps were in various mountain resorts, which kept open only during the hot and humid summer months, and in large cities, operated during the winter, or, as in the case of Calcutta, the year round. While the camps were excellent in maintaining morale and general health they introduced venereal disease control problems of considerable magnitude. Many of the men went to them not only for rest but also for the sexual contacts which were easily secured. Prostitutes in these areas were quick in offering their favors as they found that the men usually had money in fairly good quantity and were willing to spend it.

Discussion of the problems faced at two of the rest camps will serve to illustrate the situations met generally though some differences in details existed elsewhere. The rest camps established in Calcutta will serve as an example of a large city. Two camps were located in this city, one for White, the other for Colored troops. The latter was the only one in India for Negroes.

Calcutta, the second largest port city in the British Empire, has a war swollen population perhaps double the normal size. It is the center of extensive military operations, serving as the point of entry for much of the war material coming to India. It has always had a well established set of brothels and with the influx of civilians many thousands were added to the ranks of the prostitutes.

Since American troops were stationed in and near the city, venereal disease control measures were already in effect. Many of these measures, such as the provision of recreation, out-of-bounds areas, prophylaxis stations were equally applicable to both restees and permanent party. However, the former had all of their time free and therefore could, and did, make many more contacts. Reports that men returning to their home stations claiming that they had contracted venereal disease in Calcutta became increasingly frequent. This was particularly true of the Colored troops.

Letters were therefore sent to major commanders requesting that men from their areas be briefed as to the excessive rates of infection among the prostitutes in the city, the venereal disease control measures in effect in Calcutta, and the location of prophylaxis stations.

Since no great change was noticeable, the Theater Venereal Disease Control Officer conducted an investigation in the area in April 1944. As a result of his duty he felt that the instructions already issued covered the situation as far as unit commanders were concerned. He recommended cooperation with the British military and civilian authorities for the suppression of prostitution, support of the Amendment of the Defense of India Act giving military police permission to enter known brothels for removing military personnel and the imposition of severe penalties upon the owners when such personnel were found, strict enforcement of the curfew and off-limits regulations, the establishment of three more prophylaxis stations, and that, for 24 hours, newly arrived troops be given no passes during which time they would receive orientation instruction.

In November 1944 it was still evident that no great change had occurred insofar as Colored troops were concerned. The control program in effect was good but almost all of the men were coming to the camp planning sex contacts and the use of prophylaxis was poor. Intensification of all measures was ordered with the additional provision that any man found out-of-bounds would be summarily returned to his own organization. Later reduction of NCO's to the grade of private and Summary Court Martial for privates was ordered. Finally a trial was made of broadcasting radio spots four or five times a

day, broadcasting a short statement of information to catch the soldier's attention and remind him repeatedly of what to do to prevent venereal disease.¹⁸

A rest camp in a mountain resort was established in Shillong, Assam, in the middle of 1943. In the ensuing months it was noted that venereal disease was excessive. The VD Control Officer therefore visited the camp in December 1943. He found that the camp was located in the mountains of Assam at an elevation of about 5000 feet. The population, aside from permanent and temporary British residents, consisted of the Khasi people, a light skinned native hill race. The women were much more attractive to the western eye than the valley Indians. Their women are anxious to introduce White blood into the tribe in order to further lighten the color of their skins. Consequently, it was a common practice to "shack up" overnight with White soldiers. Naturally they discouraged the use of mechanical prophylactics. Solicitation of the men was done openly, not only by the women themselves, but also by members of their families. Formerly the women paid the men but they had taken to exacting a fee by 1943. There were no established brothels or brothel areas, the women operating singly or in very small groups within their own homes.

There were two prophylactic stations in operation, the worst area, "Happy Valley," was out of bounds, military police were present to enforce cut-of-bounds rules, mechanical prophylactic kits were readily available. Lectures were given new arrivals each Monday and enlisted men were enthusiastic as to the recreation available. "Shacking-up" is obviously hard to control so that a curfew and bed-check and the provision of chemical prophylactic kits were instituted. The question of closing the camp entirely was not considered necessary at that time.

After these recommendations were put into effect some improvement was noted. Another inspection by the VD Control Officer was made in May 1944. This showed that essentially the same control program was in effect as previously noted, but somewhat more strictly enforced. There was one most important change however. A system was instituted in cooperation with the British consisting of weekly inspection of the prostitutes by a civilian physician, followed by voluntary treatment taken in a civilian clinic and the issuance of cards to the women stating that they had been examined and were under treatment.

The Theater VD Control Officer strongly condemned the participation of U. S. Army authorities in the examination and treatment of the girls, pointing out that the certificates issued were worthless and gave the men a false sense of security. He recommended the forbidding, under penalty of immediate return to his organization, any association between the soldier and Khasi women, control of the illicit trade in the semi-poisonous Khasi wine, and the opening of a post exchange for the sale of beer, cigarettes, etc.

Since no improvement was noted but instead sharply rising rates, a request was made in February 1945 for information as to the control of these infections. In reply detailed reports were submitted concerning control activities. Again there had been a tightening up of routine measures. The principal effort, however, continued to be the treatment of the prostitutes in a civilian clinic with funds provided by the British. The driving force behind its operation remained an American Sanitary Corps Officer. In actual practice the method bordered on sponsored prostitution since the girls continued to be given cards certifying that they were under observation.

Before any action could be taken and while the Inspector General was considering a descent on the camp, the area was closed as an SOS installation. Its facilities were taken over by the AAF and an Air Crew Rehabilitation Center established. The AAF desired to continue the same methods of control and requested that the officer already present be continued in the job until a replacement could be oriented. A few days later the services of the Theater Venereal Disease Control Officer were requested for consultation with the VD Control Officer of the AAF. The general situation with regard to the civilian population was found to be unchanged. The control program as set up by SOS had failed but that already established by the AAF was essentially a continuation of the previous one.

Recommendations included discontinuance of any participation in the treatment of prostitutes except for reporting contacts to the proper authorities, a vigorous educational program, strict enforcement of curfew, out-of-bounds and related restrictions and further extension of recreational facilities.¹⁹

In neither of these rest camps were the control programs particularly successful. Statistics as to the actual number of cases contracted are not available as many infections developed after the men returned to their own organizations. It is not surprising that exposure increased when the men visited the camps since they were going to them from comparatively isolated areas for relaxation which often included sex contacts. In one camp extension of the measures

already in effect was tried; in the other a system of essentially legalized prostitution failed. Perhaps better conditioning all through the soldier's Army careers, in combination with local measures, would have proved effective.

10. Attitude Surveys

In 1944 two surveys of opinion of the enlisted men were conducted to determine their attitudes toward VD control, their knowledge of the subject, and their actions regarding exposure and control methods used. The first of these was done in September 1944 at the request of the Theater Surgeon by the Research Department of the Special Services Section. The study, conducted among White and Colored soldiers in two areas, one near a large city, the other in a rural area, showed that in the populated area more soldiers had sex contacts than in the rural area; Negroes had about four times as many contacts as Whites; that preventive practice among the two groups, White and Colored, was about the same even though the Whites scored much better on a simple test of knowledge; that intercourse after drinking was more common among Whites; that professional prostitutes were the greatest source of sexual gratification; and that there was a much greater potential tendency among White soldiers to increase their sexual exposure.

The conclusions reached were that attitude conditioning had not been sufficiently effective since many soldiers had not been convinced of the seriousness of venereal disease. A diversified attitude-conditioning educational program should be continuous for all soldiers with the object of attaining a high degree of emotional convictions as to the seriousness of the infections; adequate recreational facilities and easily accessible prophylaxis stations should be provided; free condoms should be supplied and the proper methods of use taught.²⁰

The other study was conducted among the enlisted men of the 69th General Hospital in December 1944. The investigation was conducted for the purpose of determining whether previous military instruction had been effective, whether it should be continued, and how it should be altered. The men in general thought that instruction in venereal disease control had been of value but that it could be improved. Particularly they did not want the same material repeated. Their information on venereal disease control was not very good though they would use the condom prophylaxis for prevention.²¹

These two studies would indicate that instruction had in part achieved success in that many of the men used protective measures during and after intercourse. It had convinced hardly any of the desirability of abstinence, had not taught them sufficiently as

to the seriousness of venereal infections or that 100% protection was not available. Continued diversified teaching is essential to maintain good attitudes.

11. Therapy

Great advances were made in the therapy of the venereal infections during the war years. As the newer methods were introduced in this Theater loss of man days and hospitalization were both reduced as were the number of complications and treatment failures. The ambulatory treatment of gonorrhea with the sulfonamides was only partially successful.²² When the routine use of penicillin began, treatment failures dropped to near zero. OB penicillin has been in use only a short time and comparatively few cases have been treated. In these it has been almost uniformly successful in reducing the treatment of gonorrhea to a single injection.²³

Evaluation of the penicillin therapy of syphilis is more difficult. It has been in use in the Theater for but little over a year. Follow-up reports, to be sent to the Surgeon's Office monthly, were not reported faithfully so that many soldiers were repatriated before follow-up was complete. A preliminary report made in the Field Medical Bulletin for June 1945, showed a relapse rate, either serologic or clinical, in 68 cases observed for six months or more, or 9 per cent.²⁴

12. Supplies

Venereal disease control supplies were for the most part adequate in quality and quantity although initially there were some shortages. The shortages were in part the result of poor distribution. In one case prophylaxis supplies at a port of debarkation gave out entirely just after a ship had docked. As a result, 130 cases of venereal disease occurred in one group of 1573 Colored soldiers.²⁵

A note dated August 1943 in the files, apparently placed there by the VD control officer, states "At long last SOS have gotten the prophylactic kits away from the wharfs in Calcutta and distribution is about complete. They were distributed as recommended by WD letter, AG 710 (12-19-42) OB-S-SPMCE-M of January 9, 1943, Subject: Distribution of Individual Venereal Disease Prophylactics to Overseas Forces. All depots have been warned regarding possible spoilage if rubber goods are not kept in a cool dry place." This warning was pertinent since reports had repeatedly been received of defective condoms. Subsequent reports not only complained of the same thing

but of spoilage of chemical kits as well as deterioration of rubber; fungus growth and precipitation of chemicals were repeatedly observed. Care in storage did not always avoid spoilage; frequent replacement was necessary to insure protection to the user.²⁶

The issue of prophylactic kits through medical supply resulted in discontinuance of shipment by the Army Exchange Service. Post exchange supplies were soon exhausted and officers, as well as enlisted men away from their organizations, were unable to secure condoms. Authority was therefore granted to the Post Exchange Officer to buy them from the Medical Supply Officer for resale to all personnel.²⁷

13. Rates and Results

From a consideration of the attached table and chart it is noted that venereal disease rates in 1942, before the appointment of the Venereal Disease Control Officer, were unduly high, running more than 100/1000/annum for the Theater as a whole. With the beginning of a coordinated control program a sharp drop occurred, except for slight occasional upswings, to be followed by a slow, steady decline in the ensuing months and years.

Control among Colored troops is always difficult. Negro rates in this Theater have consistently been much higher than those of the Whites. There is no explanation for the single exception in February 1943. The irregularity of the Colored rates as compared to the Whites is also to be noted. The increased exposure of the Negro, as reported in the attitude survey above, may explain in part at least, the higher venereal infection. Whatever the explanation, the need for an intelligent and new approach to the Negro venereal problem is clearly shown.

That there has been an upward trend in venereal disease in this Theater as in others following the end of the war is also shown in the case of Negroes. At the time of writing there are incomplete figures showing that this trend has continued into November.

The low venereal disease rate maintained once definite control was established is evidence of the success of the policies adopted. In no other overseas area have rates as low been attained. In part the result may be due to lessened opportunity for exposure in isolated rural areas, but for the Theater as a whole, the swollen numbers of prostitutes in the cities and the excessive infection among them would probably cancel out the more favorable rural situation.

14. Summary

The China Burma India Theater (later the India-Burma Theater) began operations without any planned program for venereal disease control in a country in which the infections were exceedingly common and civilian control negligible. Comparative-ly early a Venereal Disease Control Officer was assigned to the staff of the Surgeon. Through vigorous action on his part, fol- lowing the general lines of attack on the problem as recommended by a visiting consultant, initially high rates were brought down and maintained at the lowest level of any overseas Theater. The proved measures consisting of sufficient recreation, continuous education, prophylaxis, free use of the out-of-bounds power, and the holding of commanding officers strictly accountable for ex- cessive disease within their organization, were applied with suc- cess. Colored troops consistently contracted more disease than Whites, in part because of greater exposure. More vigorous con- trol programs were generally necessary for them.

Failure to secure good control occurred only in the case of the rest camps which presented problems of particular difficulty. Essentially sponsored prostitution tried in one of them was again a failure.

The new forms of therapy introduced were successful in producing prompt cure and reducing lost time. There should be comparatively few soldiers returning to the United States with venereal disease from the India-Burma Theater.

TABLE VIII
V.D.

Rate per 1000 Per Year
White, Colored Theater (C.B.I.)*

MONTH	1942		1943		1944		1945		
	White Colored Theater								
January	73	112	78	37	157	53	23	121	36
February	66	23	48	41	144	53	25	118	38
March	34	252	62	36	164	50	22	113	35
April	33	112	44	37	186	53	18	90	28
May	43	75	47	28	92	35	17	89	28
June	36	82	41	29	86	35	19.2	69	26.6
July	39	102	47	28	72	32	21.2	104.02	33.6
August	34	122	48	29	119	38	10.14	118.95	23.94
September	65.8	467.7	140.0	43	216	72	32	163	44
October	120.5	370.9	144.5	32	102	42	29	113	37
November	78.2	180.0	95.7	32	179	55	20*	119	32
December	73.0	270.5	101.8	23	178	44	22	144	37

VENEREAL DISEASE
Rate per 1000 per Year
Colored, White and Theater

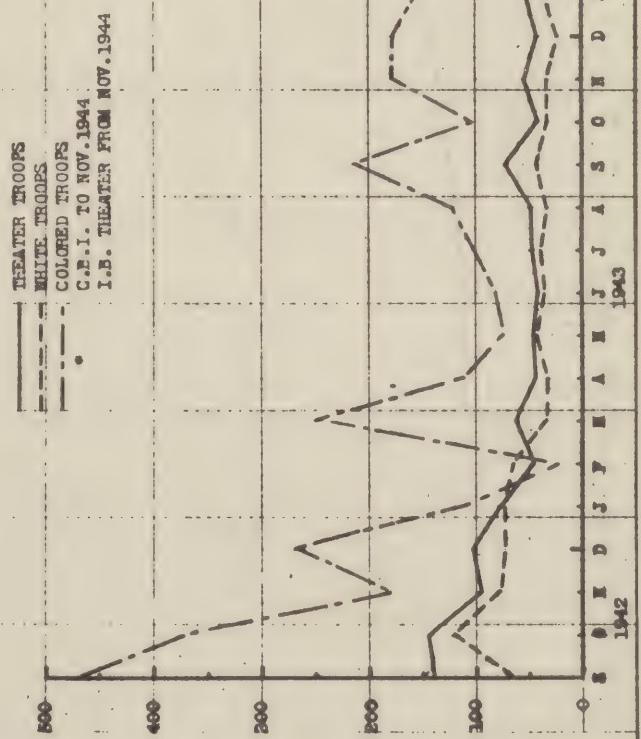


CHART VII

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XIV: CONTROL OF INTESTINAL DISEASE

1. General Measures

Sanitary practices, both personal and communal, among the overcrowded population of India are exceedingly primitive. Age old customs have remained unchanged through the centuries. Nowhere is any attempt made to dispose of waste materials. Feces, garbage and other filth are deposited promiscuously. There is a close relationship between these wastes and the native Indian; not only his hands and bare feet but everything he uses are in a constant state of contamination. His food is unprotected from flies, rodents and dust, and there is an almost complete lack of refrigeration. The same contaminated water is used for drinking, bathing and washing. Flies are accepted as a normal part of the environment. Disposal systems are almost non-existent.

These conditions, combined with the hot humid climate in which organisms multiply rapidly and survive for long periods, are obviously conducive to the spread of the intestinal infections. Diarrhea and dysentery, both bacillary and amebic, are constantly present in a large part of the population. Typhoid and paratyphoid fevers are common. Cholera is endemic and every year severe epidemics occur. Nearly all of the population is infested with intestinal helminths.¹

It is not surprising that these infections quickly became established in American troops arriving in the Theater. They were unprepared to deal with the problems confronting them in a country where standards of sanitation were so different from those at home and where close contact with the native population was necessitated by the military situation. Of the enteric infections, only the diarrheas and dysenteries caused much sickness in American troops. Typhoid was rare, probably because of the protection afforded by immunization. A few cases of helminthiasis were observed. No cholera occurred in American troops.

There was no organized control program for the enteric infections until 1944. A letter had been written in August 1942, on the handling of fresh fruits and vegetables prior to consumption² and another in December on the treatment and prevention of certain tropical diseases.³ The latter devoted only two lines to the control of enteric infections, stating that they could be prevented by good sanitation. Nearly a year later, in November 1943, a warning against cholera in Calcutta and Madras was issued.⁴ In December 1943, cognizance was taken of the widespread use of native food handlers and instructions as to their employment issued. Methods for the preparation of fresh fruit and vegetables were also outlined.⁵ Other than these letters no recommendations were made and organization commanders were left to shift for

themselves in spite of a diarrhea and dysentery rate which had reached 256/1000/annum in 1943 and 326/1000/annum in 1944.

In June 1944, a Sub-Commission on Dysentery of the Army Epidemiological Board arrived in the Theater to investigate the excessive diarrhea occurring here. Surveys were conducted by this group in two areas, Calcutta and Ledo. In both places conditions were reported to be far from satisfactory, the criticism applying equally well to diagnosis, treatment and prevention. General sanitary conditions and practices in many organizations were poor. Ordinary cleanliness was not observed and in some places flies were prevalent. The importance of water in the spread of dysentery was difficult to evaluate but inadequate purification procedures were often noted. The most important method of spread was believed, however, to be by food and food handlers. The widespread use of Indians in kitchens and mess halls was particularly condemned. Even though carrier rates in natives were generally lower than in the soldiers examined, their complete lack of personal cleanliness rendered them especially dangerous. "Of great importance is the experience of a number of organizations that as soon as they removed Indians from the kitchens the diarrheal rates dropped." Periodic examination of food handlers to detect carriers was recommended. Fresh fruits and vegetables should be sterilized by immersion for one half hour in high chlorine content (200 ppm) water.

The Commission also reported on the poor diagnostic procedures in use; most laboratories were working with inadequately trained personnel and lacked supplies and equipment. Bacteriologic diagnosis was practiced in few laboratories and the identification of protozoa was often inaccurate. Interest of medical officers was stimulated and the opportunity thus afforded taken to instruct them in the diagnosis, treatment and prevention of the diarrheas. Particular attention was given to improvement of the laboratory service.

The Commission believed that amebic dysentery was a far greater problem than the bacillary type, not only because of its greater incidence but because so many cases were going on to chronic stages of the disease. Amebic infection tended to be prolonged whereas the bacillary cases were usually mild and of short duration. Treatment with sulfadiazine would quickly control Shigella infections; carriers should be eliminated from whole organizations promptly. Treatment of Endomeba histolytica infections was much less satisfactory.⁶

The sharply rising diarrhea and dysentery rates which began in April 1944 and reached an all time Theater high of 326/1000/annum in July combined with the presence and reports of the Sub-Commission on Dysentery finally brought the attention of the Surgeon forcibly to the importance of the diseases. A campaign was therefore begun to bring them under control. Upon having the situation brought to his attention

the Theater Commander directed his subordinates to take immediate corrective action by every possible means. Those organizations showing the highest rates at the time were singled out for particular attention by means of letters through command channels requiring explanations for the excessive diarrhea and a description of remedial measures being taken. An officer was assigned to the staff of the S.O.S. Surgeon as a special sanitary inspector to spend practically all of his time checking mess sanitation throughout the Theater.

In October 1944 material had been gathered for a detailed report on the Theater experience. It showed that there had been an 80 per cent increase in the diarrheal diseases from April to July with a slight decrease since then. The greatest increase had been in Base Section 2, at the 24th Station Hospital, and in the Railway Operating Battalions. Over 16000 cases of dysentery had been hospitalized in a five month period. Assuming that three times that number of cases had remained on duty, the total number of cases was calculated to be 66,000. The average duration of the disease was probably about three days; thus 200,000 effective days were lost. Causes listed were failure on the part of many commanding officers to enforce sanitary regulations, poor mess sanitation through lack of American supervision and use of native food handlers, eating in other than established Army messes, inefficient fly control, insanitary disposal of wastes, and contaminated water supplies.

Corrective action already taken included (a) the organization of a Preventive Medicine Section; (b) letters of inquiry to organizations with high diarrheal rates; (c) better distribution of sanitation supplies including compound germicidal rinse for the sterilization of mess gear and cooking utensils, insecticidal spray for fly control, and an all-purpose soap; and (d) the preparation of a circular on water supply. It was recommended that, in addition to the above, commanding officers be held strictly accountable for sanitation and that native labor in Army messes be reduced to a minimum and kept under strict American supervision.

The Kelser Mission arrived in October, 1944, and resurveyed the whole problem. The earlier findings were confirmed. Additional defects noted included inadequate refrigeration and water heating facilities, and "a belief among medical and line officers that the 'GI's' and dysentery are inescapable in this Theater, leading to a spirit of defeatism in the face of the enormous sanitary problems confronting them." There was a general lack of laboratory facilities for accurate diagnosis of cases and bacteriologic control of water supplies, only the 9th Medical Laboratory and some of the general hospitals being equipped for good service. The improvement already begun by the Theater Surgeon was noted. Recommendations included

action to provide safe water generally and along the main traveled rail routes, better control over civilian eating places, and the elimination or strict control over native food handiers.⁷

By the fall of 1944 the seriousness of the problem had become fully recognized; it had been carefully surveyed and the principal causes discovered. Corrective action had been started and the organization in the Surgeon's Office established to maintain a continuous control program.

In implementing the program, continuous propaganda was maintained by the Surgeon's Office through the issue of directives, periodic inspections, and distribution of information as to new sanitation methods and materials. Action was taken to insure the availability at all times of needed supplies. Section Surgeons were urged to take action in appropriate cases without waiting for decision from a higher echelon. Educational programs were begun to teach commanders that these diseases are preventable. In some areas periodic lectures were delivered to all personnel concerning the infections and methods of preventing them. A close watch on rates was maintained by the Surgeon. Whenever an organization showed an undue increase of diarrhea command letters were prepared asking for reasons for the outbreak and the measures being used to control it. When, as frequently occurred, excessive diarrhea persisted in an organization, inspectors went to the unit to conduct detailed surveys and to initiate corrective action on the spot.¹⁰

It has been evident during the surveys that laboratory facilities in many parts of the Theater were unsatisfactory, only the general hospitals and the 9th Medical Laboratory providing services that were reliable. Diagnosis of the enteric infections was inaccurate or was not attempted. E. histolytica was not recognized by some laboratories; in others anything that moved under the microscope was diagnosed as this parasite. Bacteriologic diagnosis was simply not done. Bacteriologic examination of water, ice, and milk was often unavailable. The faults lay in inexperienced, untrained personnel in the laboratories and lack of equipment and supplies authorized for the smaller hospitals which served much of the Theater.

To bring about improvement a Theater Laboratory Consultant was appointed with the responsibility of raising the standards of performance of the laboratories throughout the Theater. During the spring of 1945 he visited all of the hospital laboratories. Corrections were made on the spot where possible; longer training was given on an apprenticeship basis in the 9th Medical Laboratory. Five officers and thirty-nine enlisted men were so trained. Shortages of equipment were corrected. Full use of the facilities of the 9th Medical Laboratory was urged.¹¹

2. Food and Food-handlers

The surveys had shown that the most important reason for the excessive diarrhea lay in the handling of food and food handlers. The provision of more food inspection teams, refrigeration, and the insistence on proper preparation of locally obtained food improved the actual food supplies. Native food handlers were never eliminated; the system of employing them was too firmly established. Close American supervision was insisted upon but they remained a sore spot and a frequent source of infection. Mess sanitation is more fully discussed in another section of this history.

The actual tracing of outbreaks of dysentery to contaminated food supplies was infrequently accomplished although the connection was frequently enough suspected. There occurred in Assam in April 1945 three outbreaks of dysentery in which, on epidemiological grounds, locally procured fresh eggs were incriminated. From the patients in one of the outbreaks Salmonella enteritidis was isolated, from the second, a member of the genus Eberthella, and from the third, Shigella paradyENTERIAE, Boyd 88. None of the eggs supposedly causing the outbreak were available but others, similar in origin and handling, were bacteriologically tested. Of 84 eggs tested, 23 showed organisms of fecal origin as well as some streptococci and staphylococci. No definite intestinal pathogens were isolated. Because of these findings, medical officers were warned via the Field Medical Bulletin that raw egg products were dangerous and should be avoided. Both hen and duck eggs were being furnished at the time and could not always be distinguished. Later instructions prohibited the use of duck eggs in view of their notorious reputation as carriers of food poisoning bacteria. It was further recommended that, unless refrigeration could be provided, no more eggs be shipped to Assam during the hot weather. They came from great distances and it was often necessary to discard, because of obvious spoilage, as many as 75 per cent of the eggs just prior to use. Improved candling facilities at the point of origin eventually reduced the losses but could not compensate for lack of icing during shipment.¹²

In other outbreaks various foods were incriminated but the evidence supporting the opinions was usually not convincing. In others, there were obvious breaks in sanitation which could be corrected and recurrences prevented. For the most part good sanitation would have prevented these occurrences.

3. Water Supplies

Contaminated water was frequently blamed as a source of infection; it probably did contribute to the total cases. Unsafe supplies of water were not uncommon as shown by bacteriological examination. After a water control program was begun in 1944, supplies were greatly improved and disease ascribed to it greatly reduced. The Theater program has been discussed in some detail in Part II above.

One outbreak of amebic dysentery was fairly well traced to a water supply. In April, May, and June 1944 the 24th Station Hospital reported 97 cases of amebic dysentery; this number was about a third of the entire detachment. All cases were diagnosed as amebic dysentery but about a third of them were asymptomatic and should have been classed as carriers. No cases occurred in the patients in the hospital. Both groups ate food prepared in the same mess but a different water supply was used. The water used by the patients was uniformly potable on bacteriologic testing; that for the detachment regularly showed fecal contamination. Finally, when boiling of all water was introduced, the epidemic stopped. The Sub-Commission on Dysentery reported, without giving details, another outbreak possibly due to water.¹³

4. Flies

Flies are exceedingly prevalent in India because of the general failure to dispose of waste materials. Breeding could be and was prevented by good sanitation in areas under military control. It was when such areas were close to native habitations that difficulty was experienced. Control was obtained through screening of mess halls and the use of fly traps, spray and fly paper. Latrines were fly proofed and the pits treated with various larvicides. Garbage was buried or incinerated. In 1945 DDT became available in sufficient quantity to permit residual spraying of all buildings. Applied every month or two it greatly reduced the fly population but did not permit relaxation of other methods of control. Interestingly enough it was reported that in those areas where air spraying for mosquito control was regularly done, flies were also greatly reduced in number.

5. Immunization

Immunization against the typhoid fevers and cholera was highly effective in preventing these diseases. Theater policy originally called for injections of typhoid vaccine twice yearly but annual injections only were required after 1944. A few cases of typhoid did occur

but all were widely isolated. No cholera was observed in American military personnel, although one Red Cross worker contracted it. The absence of the disease may be attributed to the semi-annual immunization required plus good fortune. In the home of cholera and where sanitation was so poor, complete avoidance of exposure could hardly be expected. That immunization does not afford complete protection was shown by the occurrence of cases in a nearby Theater.¹⁴

6. Carriers

The elimination of carriers in an organization, particularly food handlers, is important in preventing enteric infections. Not until 1944 along with other control measures was any particular attempt made to find these individuals. Beginning at that time the entire personnel of numerous organizations were surveyed, the chief interest being in the detection of amebiasis. Unfortunately, surgeons did not distinguish between carriers and actual cases of dysentery; all of these individuals were diagnosed as amebic dysentery. Instructions were required from the Surgeon's Office stating that asymptomatic individuals would be diagnosed as "Carriers, *E. histolytica*" to correct the artificially high dysentery rates. For the Theater as a whole the increase was probably not great but in individual organizations these surveys sometimes resulted in unduly elevated figures.¹⁵

In Assam and Burma the surveys were, for the most part, conducted by the 9th Medical Laboratory and in other areas in the Theater by local hospitals and dispensaries. The studies showed great variation in carrier rates in different organizations but they were almost always higher in the Calcutta area than elsewhere. In Assam and Burma from 3 to 4 to as high as 18 per cent of the men harboured the organism. In only two instances were higher infection rates observed: in the 24th Station Hospital during its epidemic and in an organization which had just spent several months in Bengal. The respective percentages in these instances were about 33 and 28. In Calcutta it was not uncommon to find nearly 20 per cent of the men infected in organizations having little dysentery; somewhat higher percentages were observed in units with numerous cases of diarrhea. In the Delhi-Agra areas, in a few surveys, from 5 to 10 per cent was the usual range found. Surprisingly, there were only from 5 to 10 per cent of native Indians infected whenever examined. This figure was rather consistent wherever large numbers of food handlers were examined and the laboratory work reliable.

Comparatively few studies were done for Shigella carriers. Where they were carried out incidence of infection was usually low, being from 1 to 2 per cent. The Sub-Commission on Dysentery had reported bacillary was relatively less important than amebic dysentery, and stated:

"While bacillary dysentery has been of great importance in all previous wars and in certain areas has been important in this one, further study in Advance Section #3 failed to show that it was of major importance in the parts of India visited (Ed. note: Calcutta and Ledo, Assam were studied). Cases occur and the more search is made the more cases are found. Most of the infections are mild and no great numbers of troops are involved. This is in part due to the isolation of many of the units. It cannot be too strongly emphasized that bacillary dysentery is potentially of great importance and careful watch should be kept, especially in the summer months, for beginning epidemics."

In addition to surveys of entire organizations most units had their food handlers periodically checked in the laboratory. Incidence of infection in these individuals was of much the same order as the figures above. Elimination of infected personnel from the kitchens by this means was followed by a definite drop in diarrhea in a number of instances.¹⁶

In May 1945, a second Medical Laboratory (Army or Communications Zone) arrived in the Theater. It did not appear to be necessary to utilize this unit for its usual mission since the laboratory service already established was well organized and running smoothly. It was instead given the problem of studying the etiology of the common diarrheas, the so-called "Delhi Belly". It was particularly desired that studies on the pathogenicity of the paracolon organisms be made.

The Laboratory was divided into two parts. One was set up in Calcutta, the other in New Delhi, as in both places there was enough diarrhea to insure sufficient material with which to work. The program included collection of clinical data and specimens from patients as they reported to dispensaries for treatment, detailed bacteriologic and parasitologic examination of the specimens, and correlation of the results. In the ensuing four months somewhat more than six hundred cases were studied by these methods.

Similarities and differences were noted in the two areas. Amebic dysentery and carriers were much more frequent in the Calcutta area. Both groups found about the same numbers of the Shigella and Salmonella organisms. Carriers were no greater among the Indians than among U. S. troops; in fact carriers of E. histolytica were only about half as frequent in the natives in Calcutta as in the Whites there.

The symptomatology was not a guide as to the type of etiologic agent in these diseases. The fecal exudate was not helpful in establishing a diagnosis.

The paracolon organisms occurred with equal frequency in both symptomatic cases and asymptomatic controls, and in the two areas in which studies were done. However, on breaking down the bacteria into groups, there was observed a great preponderance of the intermediate paracolons. This finding was quite dissimilar to the results of other investigators who had studied U. S. troops elsewhere. Since the largest group of paracolons found in Indian controls were also intermediates, the finding in Americans may indicate only that transfer occurred under conditions of relatively poor sanitation. Experiments to prove the pathogenicity of these organisms were not carried out.¹⁷

7. Incidence of Internal Disease

Examination of the accompanying table and chart will show the Theater experience with the diarrheas and dysenteries. The most striking feature is the regular seasonal increase in incidence. Beginning in April or May each year has seen a sharp increase persisting until August or September. This is the hot season of the year when the torrential rains of the monsoon descend. Not only is the warm humid weather conducive to the spread of the diseases but it also makes the operation of control programs more difficult. Flies breed more rapidly, food spoils, fungi grow in nearly everything, the rains make disposal difficult, and water supplies are more readily contaminated.

Until late in 1944 when diagnostic facilities were adequate, the common diarrheas constituted the majority of the cases. The improvement in the laboratories, occurring then, made accurate diagnosis possible and more of the cases were properly classified. The greatest change occurred in the diagnosis of amebic dysentery; the diagnosis of bacillary dysentery was also made somewhat more often. There remained the unclassified group which continued to show much the same percentage of total cases.

In July 1944 the all time peak of 326 cases per 1000 per annum was reached. The rates generally in that year were the highest observed although 1943 had not been far behind. The improvement that can be obtained, even in a country such as India, is clearly demonstrated by the experience of 1945 when the incidence of the diarrheas was far lower than at any time before, and particularly less than in 1944. This experience proved again that a well organized control program, waged unremittingly, can control the diarrheas and dysenteries.

8. Summary

The China-Burma-India Theater began operation in 1942 in a country in which even basic sanitation is entirely lacking. Age old tradition has maintained the same practice unchanged. Diarrhea, dysentery, the typhoid fevers and cholera are exceedingly frequent, and better methods than the habits of the natives could hardly be devised to insure their spread. The infections were quickly established in American troops.

Until 1944 only sporadic efforts to control the diseases were made. In that year three surveys of the situation were made following which an effective control program was devised and enforced. Improvement in general sanitation, control of food handlers, better methods of food preparation and preservation, improved water supplies, control of flies, attention to disposal of wastes, elimination of carriers, and insistence that commanding officers assume their responsibility for sanitation, contributed their share to the great reduction obtained. The education of officers and enlisted men to the fact that these diseases are not inevitable was a vital part of the program. Their interest and desire to prevent the infections are necessary to secure results. That the effort expended was worth while is demonstrated by the results obtained in 1945 when diarrhea and dysentery caused less than half the disability of previous years.

TABLE IX

<u>Diarrhea & Dysentery</u>											
<u>Cases</u>											
1942											
JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Total								165	114	131	205
Common Diarr.								133	82	90	166
Bacillary								3	6	7	4
Amebic								10	20	23	19
Unclass								19	6	11	14

1943											
Total	197	170	267	346	360	332	898	765	983	942	673
Common Diarr.	151	95	168	248	258	259	686	526	702	568	411
Bacillary	3	15	27	18	25	14	51	68	89	181	86
Amebic	20	35	23	22	35	18	47	75	101	94	111
Unclass	23	25	49	58	42	41	114	96	91	99	65

TABLE IX
Theater Cases
Diarrhea & Dysentery

	Cases 1944												1945											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	973	713	1703	1909	2550	4021	4235	3793	3310	2029	1506	1811	1067	1113	1704	1752	1329	1957	1879	2017	1156			
Comm. Diarr.	700	506	1199	1381	1790	2700	2797	2282	1628	972	706	680	414	435	745	863	730	984	1039	1092	560			
Bacillary	127	61	124	159	117	196	203	294	270	189	133	108	105	66	152	154	132	188	161	184	116			
Amebic	80	77	138	207	398	606	616	675	884	615	519	680	454	410	535	464	294	503	491	523	359			
Unclass	66	69	242	162	245	519	619	542	528	253	148	343	94	202	272	271	173	282	186	218	121			

TABLE X

Diarrhea & Dysentery

Rate Per 1000 Per Annum

1942

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Total												
Comm. Diarr.												
Bacillary												
Amebic												
Unclass.												

	1943											
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Total	110	113	138	120	152	158	256	226	238	149	116	101
Comm. Diarr.	84	63	87	86	109	107	196	155	170	90	71	62
Bacillary	2	10	14	6	11	6	15	20	22	29	15	12
Amebic	11	23	12	8	15	7	13	22	25	15	19	9
Unclass.	13	17	25	20	18	17	33	28	22	16	11	18

TABLE X

Theater Rate
For
Diarrhea & Dysentery

DD - 1944 Rate Per 1000/Annum

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Total Th.	129	88	145	186	214	258	326	280	186	140	111	103
Comm. Diarr.	93	62	102	135	150	173	215	168	92	67	52	39
Bacillary	17	*8	11	15	10	13	16	22	15	13	10	6
Amebic	11	10	12	20	33	39	47	50	50	43	38	39
Unclass.	9	9	21	16	21	33	48	40	30	17	11	20

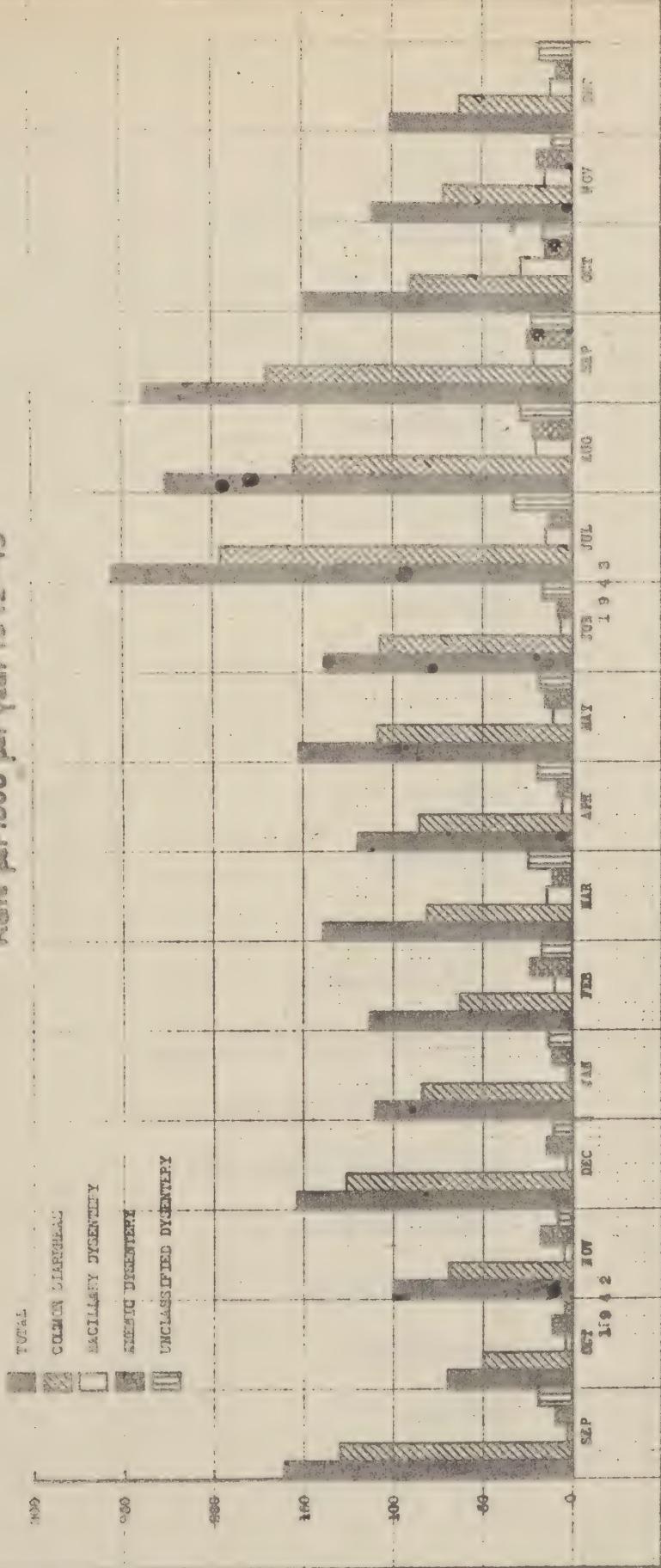
	1945											
Total Th.	70	70	83	110	90	132	142	119	87			
Comm. Diarr.	27	27	36	54	49	66	78	65	42			
Bacillary	7	4	7	10	10	13	12	11	9			
Amebic	30	26	26	29	20	34	37	31	27			
Unclass.	6	13	13	17	12	19	14	13	9			

* A Rate of 6.2 was obtained for Rate Books, but was in error due to No. of cases. Was 51, and should have been 61.

CHAPTER VII

DIARRHEAS AND DYSENTERY
BY TYPES

Rate per 1000 per Year 1942-43



DIARRHEAS AND DYSENTERY
BY TYPES
Rate per 1000 per Year 1944-45

■ TOTAL
■ CLOSTRIDIUM
■ ACUTE DYSENTERY
■ AM. TYP. DYSENTERY
■ SPECIFIED DYSENTERIES

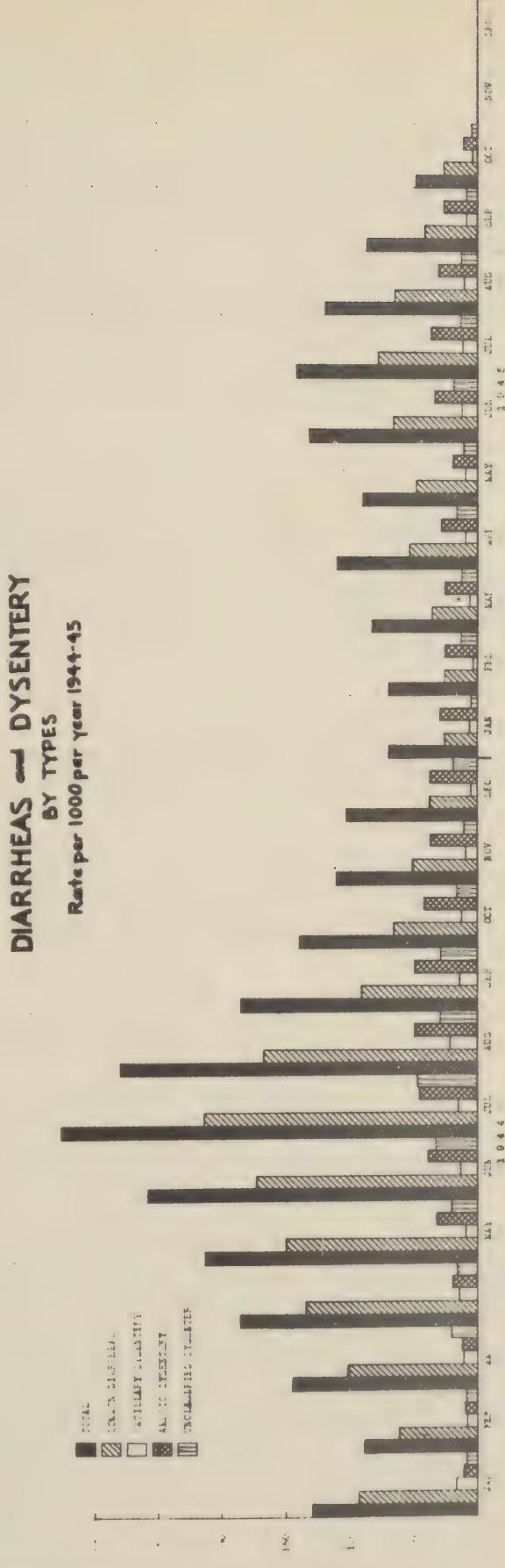


CHART VIII

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Considering malaria alone, it is known that some three-quarters of a million soldiers suffered from the disease overseas. Many of these will relapse within the next two or three years in every corner of the United States.

The collective effect of these exposures and experiences cannot now be assessed and might, indeed, turn out to be insignificant. Nevertheless, good preventive medicine and public health practice demands that preparations for combating disease be made as soon as the threat of increased prevalence is evident. To wait until the menace has been translated into reality - or to wait to see if it will thus eventuate - is too late and loses, for the professional sanitarian, an advantage of inestimable importance.

Hundreds of thousands of service men, their wives and children, will be going to and coming from areas of occupation or overseas military outposts in succeeding years. Some of these are located in the tropics. Sanitary surroundings on duty will undoubtedly be much improved over those of active combat, but in spite of the highly effective efforts of the Army Medical Department, it is inevitable that cases of latent infection will return to the country unrecognized.

Global air traffic, ever increasing in speed and distance covered, provides another channel for the introduction of new vectors and occult cases of infection from areas previously considered remote. Insect control in airport areas, disinsection of planes, immunization and physical inspection of passengers and crews can provide at best imperfect measures of exclusion.

Certain endemic infections are extending themselves within the States. Murine typhus in the southeastern quadrant is increasing. Sylvatic plague in the wild rodents of the West is now infiltrating eastward at a significant rate. The increasing densities of mosquito carriers of dengue and yellow fever in the South Atlantic and Gulf States must be considered of public health importance. There are substantial indications that certain insects, now considered to be of pest significance only, may be concerned in the transmission of virus diseases of the central nervous system.

The consequences of negligence and disregard in professional training, epidemiologic investigation and operational control experience in respect to the conditions noted above reveal themselves in such episodes as the following:

In 1930, Anopheles gambiae was discovered to have invaded Brazil, presumably from West Africa. Before this vicious malaria vector had been exterminated in 1942, thousands of persons had died of malaria, hundreds of thousands had been incapacitated temporarily by it and millions of dollars had been spent in its control - and all because of the importation of a foreign vector of disease.

XV: SCRUB TYPHUS

Scrub typhus fever first made its appearance among Chinese and American troops operating in upper Assam and Northern Burma in the latter part of 1943. Careful studies, both clinical and epidemiological, were made of the first major outbreak of the disease which occurred in November and December of 1943 and January of 1944.¹ Major D. C. Pepper, MC, of the 20th General Hospital was placed in charge of field investigations of this outbreak and Lt. Colonel Gilliam, USPHS, carried on laboratory studies which resulted in the isolation of strains of the causative organism from patients. These strains were subsequently forwarded to the United States for further study.

During the spring and summer of 1944, scrub typhus reappeared in epidemic form, occurring in the 5307th Regiment ("Merrill's Marauders") during the campaign through Northern Burma which terminated in the capture of Myitkyina. This outbreak was closely studied and a detailed epidemiological review of cases was prepared by Captain (then Lieutenant) John J. Sayen of the 20th General Hospital.^{2, 3} This outbreak was also the occasion of sending the Theater Epidemiologist, Lt. Colonel (then Major) Kirk T. Mosley, MC, to make field investigations aimed particularly at developing protective measures against the disease.^{4, 5, 6, 7} These investigations included studies on the effectiveness of the mite repellent (dimethyl phthalate) under the climatic conditions peculiar to that region and type of warfare. In addition, Captain Henry Fuller of the 25th Field Hospital conducted preliminary field investigations directed toward obtaining basic epidemiological data on the disease as it occurred in Northern Burma with particular reference to the identification of the vector or vectors and reservoir host. The magnitude of the problem being fully recognized, plans were made to obtain the assistance of the U.S.A. Typhus Commission to carry on field and laboratory investigations in the hope that the true nature of the disease would be disclosed and effective preventive measures made available.

On the 31st of July, 1944, the Theater Surgeon of the China-Burma-India Theater sent a radio message to the U.S.A. Typhus Commission in Cairo, Egypt, suggesting that in view of the serious threat of scrub typhus to operations in this Theater, the Typhus Commission render as much assistance as possible to combat this disease.

Upon learning of this request the U.S.A. Typhus Commission in Washington, D. C. decided to send a party of experienced men to India to make an intensive study of the situation and to formulate protective measures for our forces. The original party consisted of the following officers:

Colonel Thomas T. Mackie, MC
Major Gordon E. Davis, SnC
Captain Roy Melvin, SnC
Lieutenant Dick D. Millspaugh, SnC

This group arrived at CBI Headquarters on the 22nd of October 1944. After briefing in the Theater Surgeon's office they were sent to Ledo, India, on orders dated 1 November. For administrative purposes they were attached to Headquarters, Advance Section No. 3, in Ledo, and were told that they could arrange to set up their laboratory at whatever location in the scrub typhus area they considered most desirable.

After a quick survey, they decided to locate in Myitkyina, North Burma, since it seemed to be in the center of the area in which most of the disease was occurring. The party arrived in Myitkyina on the 9th of November, 1944, and began to establish its Field Headquarters. They set up in British monsoon type tents and arranged for messing in the nearby 44th Field Hospital.

It was quickly apparent to Colonel Mackie, who was in charge of the party, that an excellent opportunity for worthwhile research in scrub typhus existed in that area. It would be necessary to enlarge the organization in order to take advantage of this opportunity. After discussing the matter with Advance Section Surgeon, the decision was made to place men on detached service from organizations within the jurisdiction of Advance Section. Colonel Mackie conducted many personal interviews in order to make certain that only men who were truly interested in the proposed investigation were selected. Captain Henry S. Fuller, MC, and four enlisted men were the first locally procured personnel to be attached to the Commission. They had previously worked with scrub typhus and it was expected that they could render valuable service to the Commission. By the end of December the little group was firmly installed in its improvised quarters and the program was well under way.

Because of the urgent necessity of developing effective means of checking the inroads of scrub typhus among the combat troops in Central Burma, first emphasis was placed on the problem of prevention. A great deal of time and effort were expended in testing various uniform impregnating solutions and dusting powders. Tests on all available materials were conducted as rapidly as possible and the best available methods (hand application of dimethyl phthalate) recommended to the Commanding General of Northern Combat Area Command. Colonel Mackie made several trips up to the front lines to contact troops and their commanding officers in order to impress upon them the importance of using properly the excellent insect repellents then available.

From the very beginning of its program in this Theater, the Typhus Commission collaborated with the British Typhus Research groups. As early as December 1944, Dr. R. Lewethwaite, Director of the Medical Research Council of Great Britain, and another member of the Council spent time at the Commission Headquarters in Myitkyina in order to observe the laboratory and field work of the American groups. In return, the British were able to offer some very helpful suggestions since they

had had long experience with the terrain and the wild life of the Assam and North Burma regions.

The field work developed rapidly. Mite collecting stations and traverses were laid out over a wide area of Assam and North Burma. Along these traverses regular collections of mites and mammals suspected of being reservoirs of scrub typhus were made. In addition to being laboratory scientists the men of the Commission had to be well versed in the difficult and interesting work of trapping and shooting.

Samples of mites, rodents, and birds, were brought back to the laboratory where they were identified, dissected, and mounted. The laboratory culture of mites was started. All this required a large amount of specialized supplies which were not obtainable through the regular supply sources in the Theater. A special supply program was set up. All agencies in the Theater were instructed by the Commanding General to lend every possible assistance to the Commission. This did a great deal of good and enlisted the cooperative aid of the various supply services. For items which were not available in the Theater special requisitions were sent to the Theater Surgeon's office. From there the items were requested from Typhus Commission Headquarters in Washington by radio. A high priority, usually for air shipment, was assigned, and the supplies brought in as rapidly as possible.

In order to keep up with the laboratory experiments a constant supply of live laboratory animals was necessary. These were not available in sufficient quantity in the Theater and an arrangement was made with Typhus Commission Headquarters in the Middle East, Cairo, to obtain a running supply of gerbilles. Each month a courier was dispatched from India, travelling with high air priority to bring back 500 gerbilles. On occasions when a courier was not available from this Theater the Cairo Typhus Commission group sent up one of its own men with the animals. Other sources of laboratory animals (white mice) were the 9th Medical Laboratory at Chabua and the Haffkine Institute at Bombay. For many months the latter institution supplied up to 200 mice per month. These were supplied rather regularly beginning January or February 1945.

As the program developed and the work load increased, additional personnel was placed on detached service from various military organizations in Advance Section. It finally became apparent, however, that in view of the expanded program and the probability that the Commission would be operating in Burma for an extended period, the plan of placing men on detached service was not the best solution to the personnel problem. Inability to promote the men on detached service lowered morale and the organization was frequently upset when parent units recalled their detached personnel in order to move or to carry out some military mission. As a result of a conference with the Theater Surgeon and Theater G-1, it was decided to ask the War Department for an increase in Theater overhead personnel allotment, to be used exclusively for the Typhus Commission. In May, 1945, an official request was sent to Washington asking for an allotment of 40

enlisted grades and 12 officers. In August, Theater Headquarters received information that the War Department had approved the request for 40 EM grades and also had approved an allotment for seven officers. In order to comply with the original request, the Typhus Commission in Washington opened up five vacancies in its own T/O in the grade of captain or lieutenant, for the exclusive use of the India-Burma Field Party. Arrangements were immediately made to transfer detached service personnel into the new allotment.

In order to free the Typhus Commission of as much paper work as possible this allotment was placed under Advance Section Headquarters for routine administration. By the beginning of September the group consisted of 36 enlisted men and 14 officers. All the enlisted men had been transferred to the overhead allotment, and deserved promotions were put through. Of the 14 officers, eight were now members of the Typhus Commission T/O in Washington and the remaining six were covered by the new allotment.

The India-Burma Field Party of the U.S.A. Typhus Commission had grown quickly from the original party of four to a powerful research team consisting of 50 individuals. In June 1945 construction was started on new buildings and was completed by July. The physical plant eventually consisted of two buildings for experimental animals, an administration building, officers quarters, enlisted men's barracks, supply and storage building, and mess building.

On the 25th of July, seven members of the Commission journeyed to Kunming, China, at the request of the Chinese Government, to confer on a typhus control plan for China. Tentative plans were made, with the possibility of future UNRRA backing for a large scale attack on the Chinese epidemic typhus problem.

By the end of August the laboratories of the India-Burma Field Party had successfully isolated 32 mite strains of scrub typhus and had them well established in living animals. These were sent to Cairo in early September, where they were frozen and sent on to Washington for continued research.

In addition to the self-contained program of the Typhus Commission, the India-Burma Field Party also played host to other groups interested in various aspects of the disease. In December 1944, a group of three naval officers: Commander John M. Steele, Lieutenant C. W. Grant, and Lieutenant (JG) W. F. McLimans, arrived in the Theater. They were specialists who were interested in trying out methylene blue chemotherapy in scrub typhus. Most of the patients treated by this naval party were in the 20th General Hospital at Ledo, and in the 48th Evacuation Hospital in Myitkyina. In the middle of July, 1945, Cairo Typhus Commission Headquarters proposed sending Lieutenant Nicholas A. Tierney, USNR, a member of the U.S.A. Typhus Commission, to India for the purpose of trying out paraminobenzoic acid (PABA) in scrub typhus

patients. Lieutenant Tierney arrived during the latter part of July for a period of one month temporary duty. He proceeded at once to the 20th General Hospital where the results of his work looked so encouraging that his tour of temporary duty was twice extended and he remained until November when the 20th General Hospital and other hospitals in Advance Section were closed as a result of Theater de-activation.

With the advent of V-J Day, plans were immediately put into action to withdraw American troops from the China and India-Burma Theaters. A radio message was received from General Bayne-Jones, Director of the U.S.A. Typhus Commission in Washington, requesting Colonel Mackie to proceed at once to Washington (via Manila) for a discussion regarding the future of the India-Burma Field Party. On September 17th Colonel Mackie departed for Manila where he stopped for several days to confer with Typhus Commission personnel there, on the results of studies in the Pacific area. From Manila he proceeded directly to Washington.

On 5 October, Theater Headquarters received a radio from General Bayne-Jones indicating that the decision had been reached to close the India-Burma Field Party Headquarters on or about the 15th of December 1945. Investigations were terminated by 1 November and the time between that date and the 20th of November was used to dispose of property and equipment, pack up official records, and return personnel to the control of Theater Headquarters. The Commission officially closed its doors on 21 November.

Recognition of the superior work of the India-Burma Field Party was made on 24 November 1945 when the Theater Commander awarded the Meritorious Service Plaque to this group. Other personal awards were under consideration by Theater Headquarters at the time the Field Party returned to the Zone of the Interior.

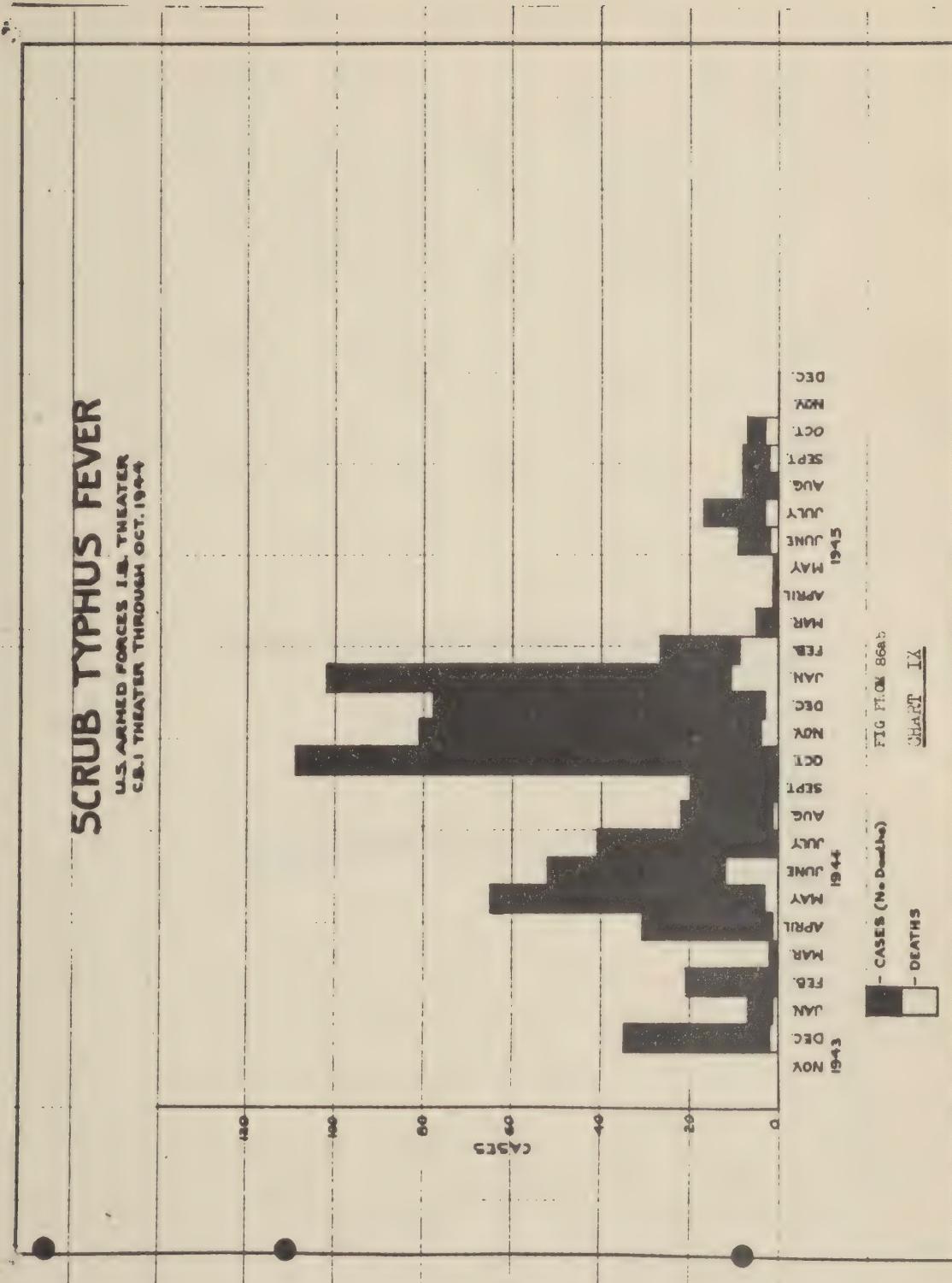
A full and detailed account of the work of the Typhus Commission in this Theater will be found elsewhere.

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SCRUB TYPHUS FEVER

**U.S. ARMED FORCES I.B. THEATER
C.B. I THEATER THROUGH OCT. 1944**



SCRUB TYPHUS
U.S. FORCES I.B. THEATER

1. Rabies

If one were to consider rabies from the point of view of incidence and mortality the disease would appear to be of little importance, even in India, when compared with diseases such as malaria, plague, cholera, smallpox, and respiratory diseases. On the other hand it has to be remembered that in rabies, incidence and mortality would give identical figures, since every case is fatal. It is this certainty of death in developed cases, as well as the horribly dramatic nature of the symptoms of the disease, that give to rabies in the eyes of the public an importance disproportionate to its case incidence. Another factor which gives rabies added importance is that it is a disease which affects a wider phylogenetic range in the animal kingdom than almost any other.

Rabies is endemic throughout India, the numerous pariah dogs that abound in the countryside serving as a reservoir of infection along with the droves of jackals. There is no known exception to the fact that all mammals are susceptible to rabies. In India it may be taken as certain that any jackal attacking man is rabid.

The season has little bearing on the incidence of the disease. In urban communities such as Delhi, however, rabies incidence will rise during the winter months at which time there is an influx of people with their dogs into the city from the hills.

The lack of a coordinated program to reduce the high incidence rate of rabies in India induced Headquarters SOS on 22 January 1943 to issue Memorandum No. 16 on the prevalence of rabies for the protection of American troops in the Theater; the Memorandum stated:

"1. Due to the wide prevalence of rabies in this Theater and the danger resulting from the contraction of this disease, it is the desire of the Commanding General that the following precautions be taken by Commanding Officers of the Services of Supply units and installations, which will to a great extent prevent contraction:

"a. Prohibit military personnel from owning pets of any kind.

"b. Discourage presence of stray dogs or other animals around U.S. military establishments.

"2. Rabies is primarily a disease of wild and domesticated animals such as dogs, jackals, foxes and wolves.

However, all warm blooded animals such as cattle, horses, goats, sheep, cats, monkeys, rabbits, camels and elephants as well as human beings are susceptible."

Along with this warning there were distributed throughout the Theater antirabic vaccines for human use. In the year 1945 there were distributed 2850 5cc ampoules received from the British. For the same period 500 14-dose units of antirabic vaccines that had been received from the United States were distributed in addition. For the use of the War Dog Detachment, 1500 5cc antirabic vaccines were received from the British for animal use.

These effective measures precluded a single case of rabies from developing among American troops in the Theater. The exact number of antirabic treatments administered is not recorded but is believed to be many times the number given to a comparable population groups in the Zone of Interior.

2. Dengue Fever

Dengue fever is transmitted by Aedes aegypti in India and is prevalent in Bengal and Madras.¹ The majority of cases among U. S. troops occurred in the Calcutta area. There was a marked seasonal incidence, usually highest during the months of July to October, and varying according to the dates of the monsoon. The incidence of dengue fever was 142 cases in 1942, 1150 in 1943, 4049 in 1944, and 2170 up to 30 September 1945. The dengue rates for 1943 and 1944 were nearly the same, but the rates during the months of July through September of 1945 were roughly half what they were during previous years.²

Although it is difficult to state definitely the causes for reduced 1945 rates of dengue fever, a large part of the improvement can be attributed to the malaria control detachments who included Aedes mosquitoes with the anophelines in their mosquito control activities. All types of mosquito control supplies were more available in 1945 and individual protective measures may have been better enforced.

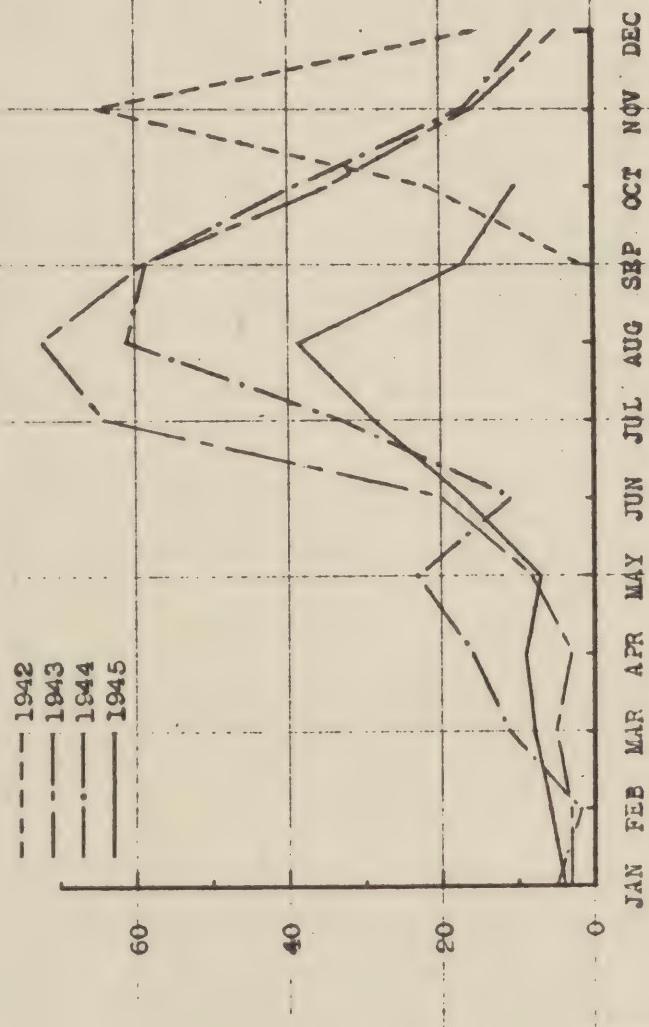
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DENGUE

Rate per 1000 Per Year

C.E.I. Theater to 1 Nov. 1944
I.I. Theater from 1 Nov. 1944



EXTRACT AT

3 Sandfly Fever

Sandflies are numerous in certain parts of India, breeding principally at the beginning and end of the rainy season. Phlebotomus papatasii, the vector of sandfly fever, is apparently found only on the plains of northwestern India.¹

The occurrence of sandfly fever among U. S. troops was markedly seasonal, from May through September of each year, with July as the peak month. Only five cases were reported in 1942, but the incidence increased to 664 cases in 1943, 1492 cases in 1944, and 417 cases in 1945. Because of the great increase in Theater strength in 1944 the rate showed a marked drop over the previous year.²

A large part of troop acquisitions during 1943 and 1944 entered the Theater by way of the west coast ports of Karachi and Bombay, thus being exposed to the bites of sandflies before they reached the forward areas. No special protective measures were taken against sandflies at that time. Bed nets and screening were not of fine enough mesh to exclude sandflies and only the general measures of applying insect repellent and the various insecticides were effective. Since repellent and insecticides were not issued in sufficient quantity until later, protection afforded was incomplete.

U. S. troops in Assam and Northern Burma were singularly free of sandfly fever. Several cases were reported from Assam in 1945, but a review of the clinical histories indicated the probability of their being dengue.³

Due to the occurrence of fever thought to be papataci at the ATC stations at Gaya,⁴ a sandfly survey was made in the late summer of 1945. A few Phlebotomus clydei were discovered in the survey but no P. papatasii.⁵ However, since no additional cases developed during the time the survey was being made, the findings were inconclusive.

General insect control measures such as the use of DDT insecticide probably contributed to the lowered incidence of sandfly fever during 1945. Another factor was that during the summer of 1945 only a small part of the Theater strength was stationed in or was required to pass through areas where Phlebotomus papatasii was present.

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SAND FLY FEVER

Rate per 1000 per year
C.B.I. Theater



PART IV - STATISTICAL REVIEW



During 1943 and 1944 the total non-effective rate for the Theater showed marked seasonal swings from lows of 31 and 34 per 1000 during March to peaks of 53 and 57 per 1000 during July and August. This swing is roughly paralleled by the admission rate for all causes, with slightly wider variations in the admission rates. The disparity between the two rates is probably due to the tendency of hospitals to discharge patients more promptly when admission rates are high. As an example, the average period of hospitalization (non-effectives divided by admissions) was about 15 days in March 1944 while it was about $12\frac{1}{2}$ in August 1944, a month of high admission rate.

During 1945 there was a marked seasonal swing in the non-effective rate. The rate was characterized by a decided downward trend which appeared in April 1945. Admission rates showed the same seasonal swing and downward trend. It is interesting to note that, over the past three years the non-effective rates for the first three months were higher each year than in the preceding year, while the admission rates were lower each succeeding year. The average periods of hospitalization during February were about 11.7, 15.8 and 19.2 days and during July 12.5, 12.0, and 14.2 for the years 1943, 1944, and 1945 respectively.

Non-battle injuries accounted for an average of about 100 hospital admissions per 1000 per year. Road building activities and routine operation of aircraft contributed a share of such admissions, while group athletics accounted for some from inactive units or rear area troops. During both 1943 and 1944 there were slightly increased admissions for non-battle injuries during the months of May and November, coincidental with the beginning and ending of the monsoon season in Assam and Northern Burma. The 1945 experience differed in that the highest rate occurred during March, following which it declined so that, by fall, it was half that of the previous year. March 1945 marked the close of major road building activity and the inauguration of regular motor convoy service to China. The Advance Section of the Theater had non-battle injury rates roughly twice those for Base Section, while Intermediate Section ranged somewhere between. Evacuation in the fall of 1945 reversed the above, however, so that Advance Section rates dropped below those for Intermediate Section.

Admissions for disease only showed a rate consistently parallel to admissions for all causes. The difference between these two rates, for the most part less than 100 per 1000 per year, amounted to roughly 10% of the admissions for all causes. Thus, throughout the existence of the Theater about 90% of all admissions were for disease only.

* See Charts VII, VIII, XI - XIX

On the basis of admission rates for all disease, the year 1944 can be said to be somewhat healthier than 1943. Only during the month of April and again in August did the admission rate for all disease exceed that for the same month of the preceding year. However, the difference was not very great and not until the end of the year did it exceed 25%. It was not until 1945 that any great improvement in health could be inferred from an analysis of statistical records. The year began auspiciously enough with monthly rates 88%, 79%, 84% and 72% of those for the corresponding months of the previous year. Speculations were made regarding probable causes for the improvement and the part played by the various policy revisions which had been made during the later months of the previous year. By July, the peak month for disease, the rate for admissions was 62% that of July 1944, and in August the rate was only 53% of that for the previous year.

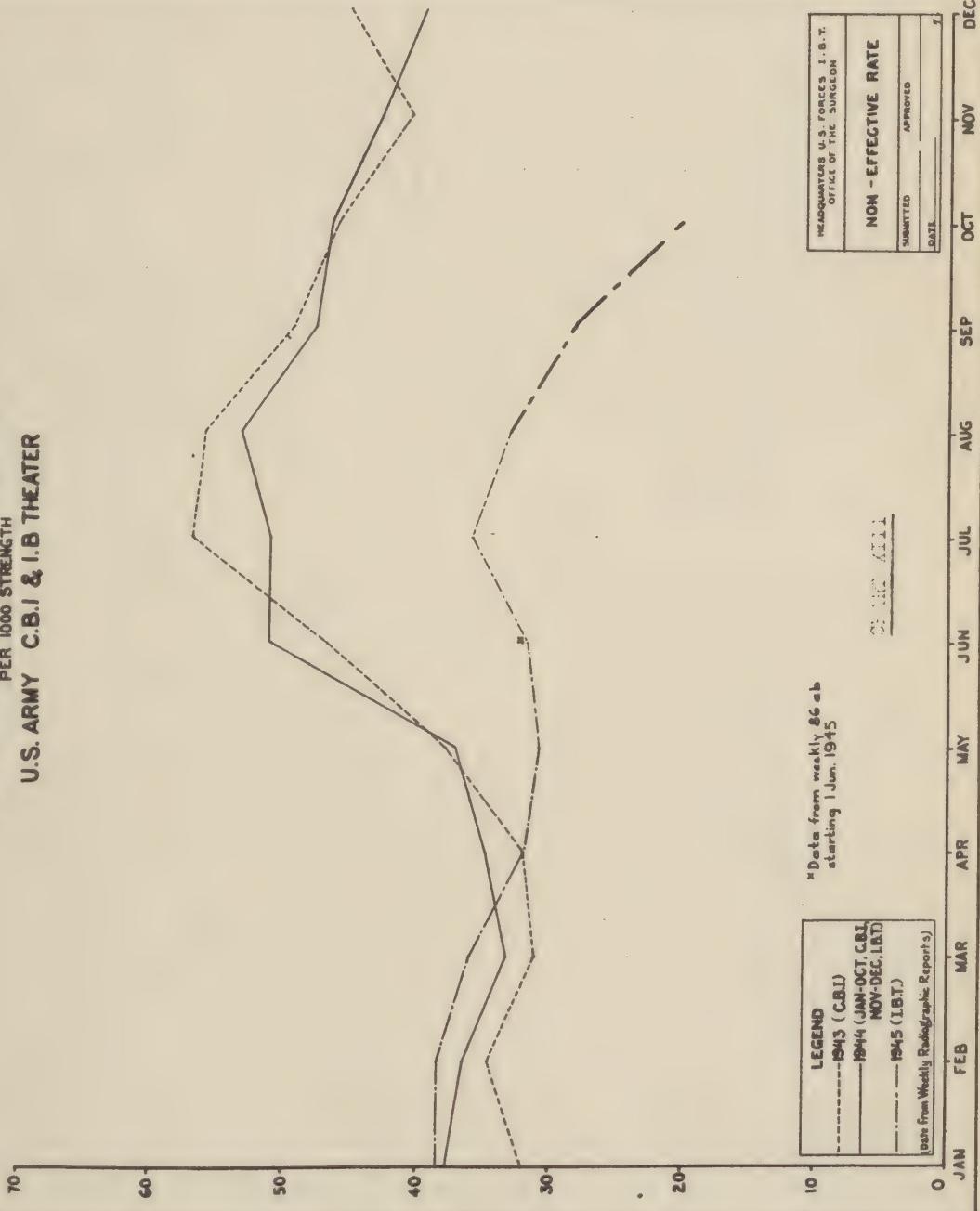
Apart from the enforcement of control measures against specific diseases, the general level of sanitation had been raised. The construction of the road had been completed and the troops were settling themselves into garrison routine. All types of sanitary supplies were more plentiful and were being used. Enemy activity continued in Southern Burma through August but did not hinder the Theater preventive medicine program, in any area occupied by American troops.

Upon examining admission rates for each of the major causes of disease in relation to admission rates for all disease, it is of interest to note that all except venereal disease have a marked seasonal character and that the period of highest incidence occurs at about the same time for each - during the months of July and August. This is so for even common respiratory disease in this Theater, unlike its tendency in the Zone of the Interior and cold climate Theaters to occur in mid-winter.

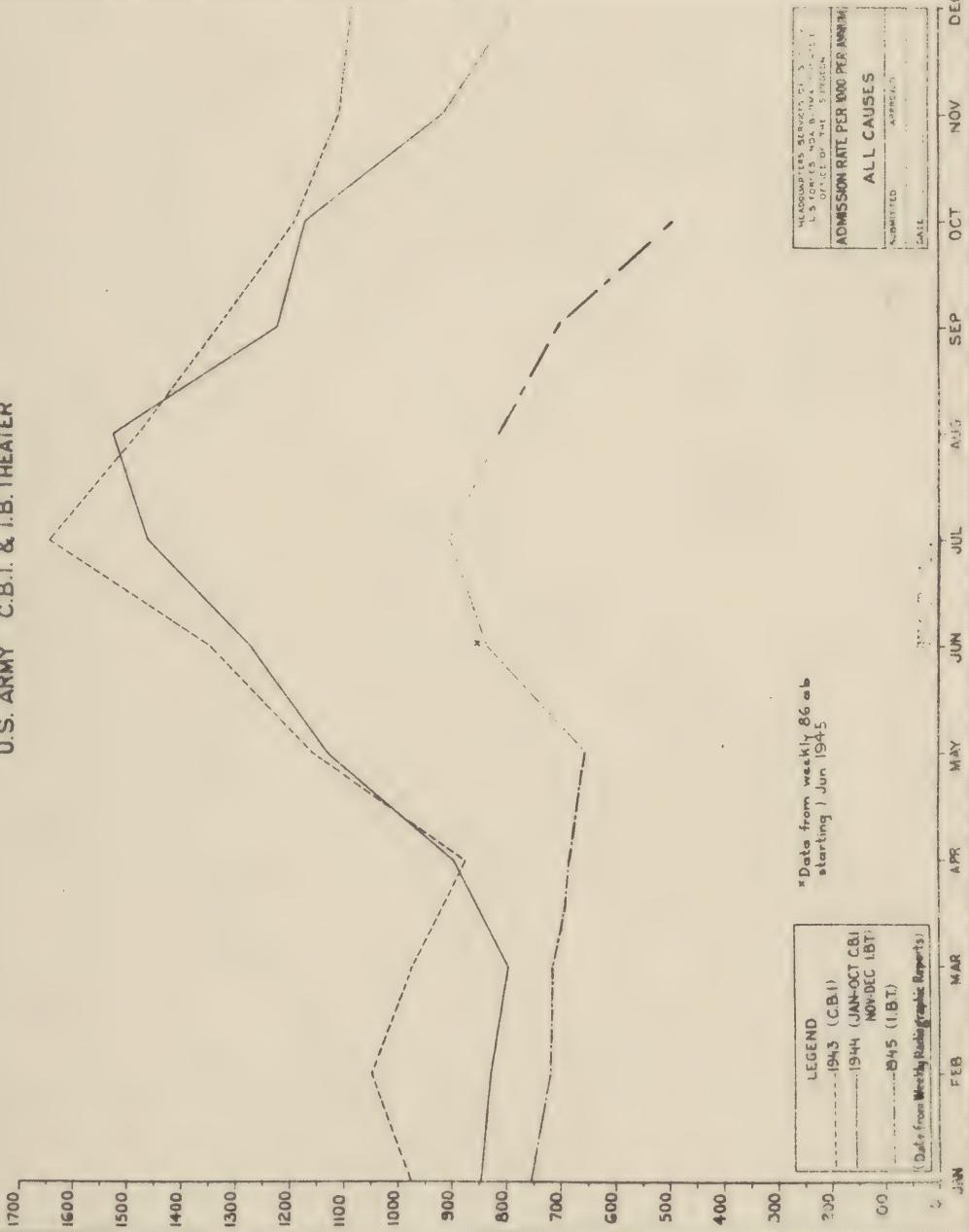
The marked improvement shown during 1945 in admission rates for disease was shared to a greater or less extent by all the major causes of disease. A comparison of the July rates for the two years 1944 and 1945 shows the following percentage reductions for each in July 1945 together with the numerical reduction in hospital admissions per 1000 men for that month.

NON-EFFECTIVE RATE

PER 1000 STRENGTH

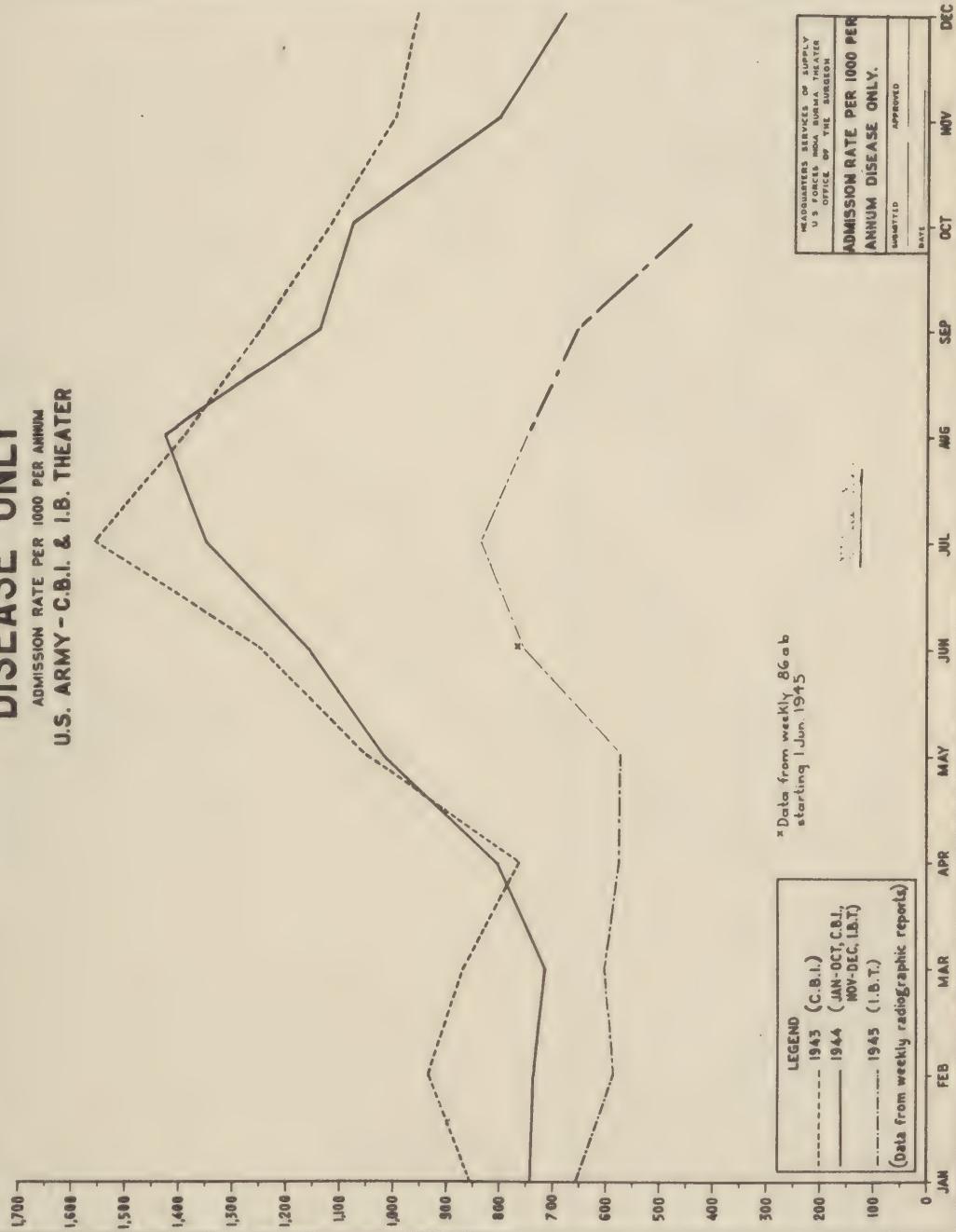


ALL CAUSE
ADMISSION RATE PER 1000 PER ANNUM
U.S. ARMY C.B.I. & I.B. THEATER



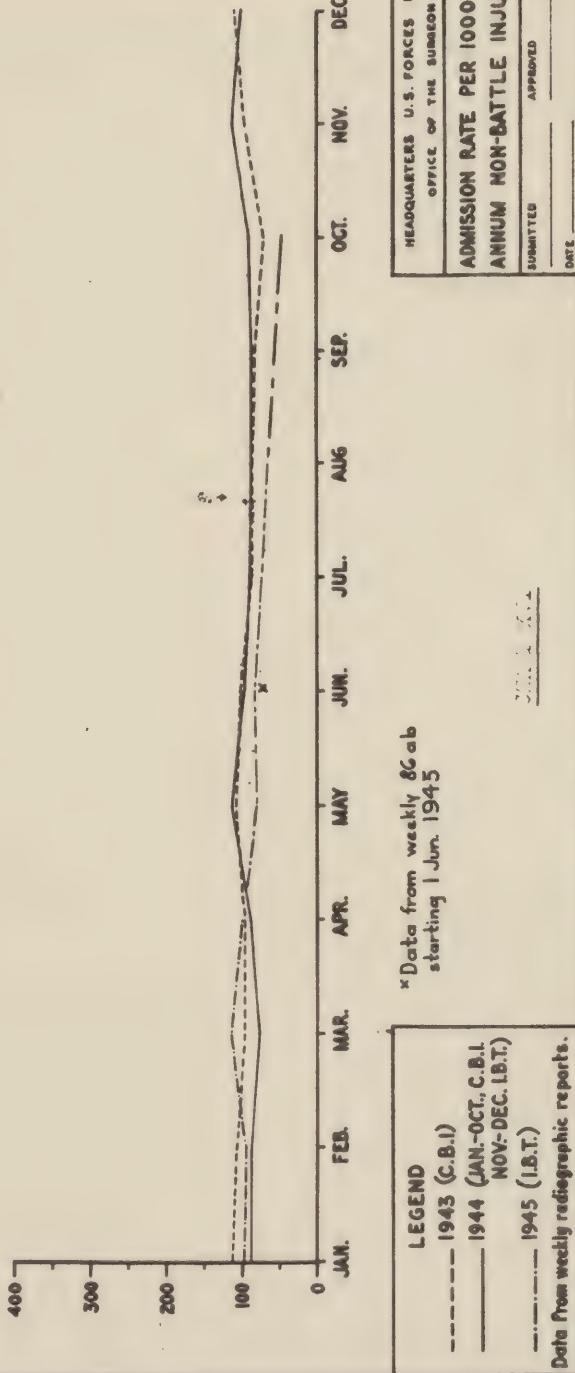
DISEASE ONLY

ADMISSION RATE PER 1000 PER ANNUM
U.S. ARMY - C.B.I. & I.B. THEATER



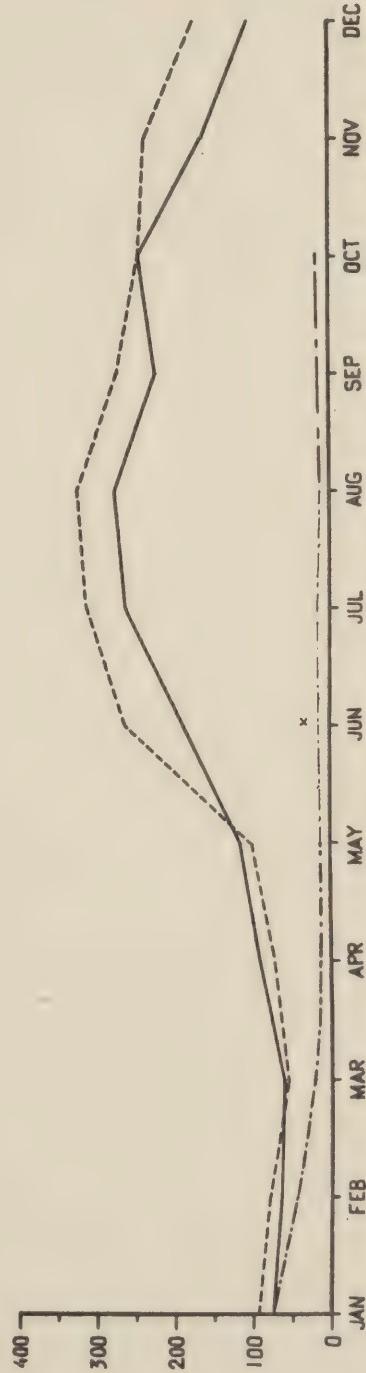
NON-BATTLE INJURY

ADMISSION RATE PER 1000 PER ANNUM
U.S. ARMY-C.B.I. & I.B. THEATER



MALARIA

ADMISSION RATE PER 1000 PER ANNUM
U. S. ARMY - C.B.I. & I.B. THEATER



LEGEND

1943 (C.B.I.)

1944 (JAN-OCT, C.B.I.,
NOV-DEC, I.B.T.)
—
1945 (I.B.T.)
- - -

Data from weekly radiographic reports

x Data from weekly 86 ab
starting 1 Jun. 1945

HEADQUARTERS SERVICES OF SUPPLY
U.S. FORCES IN INDIA BURMA THEATER
OFFICE OF THE SURGEON

ADMISSION RATE PER 1000
PER ANNUM MALARIA

APPROVED
SUBMITTED
DATE

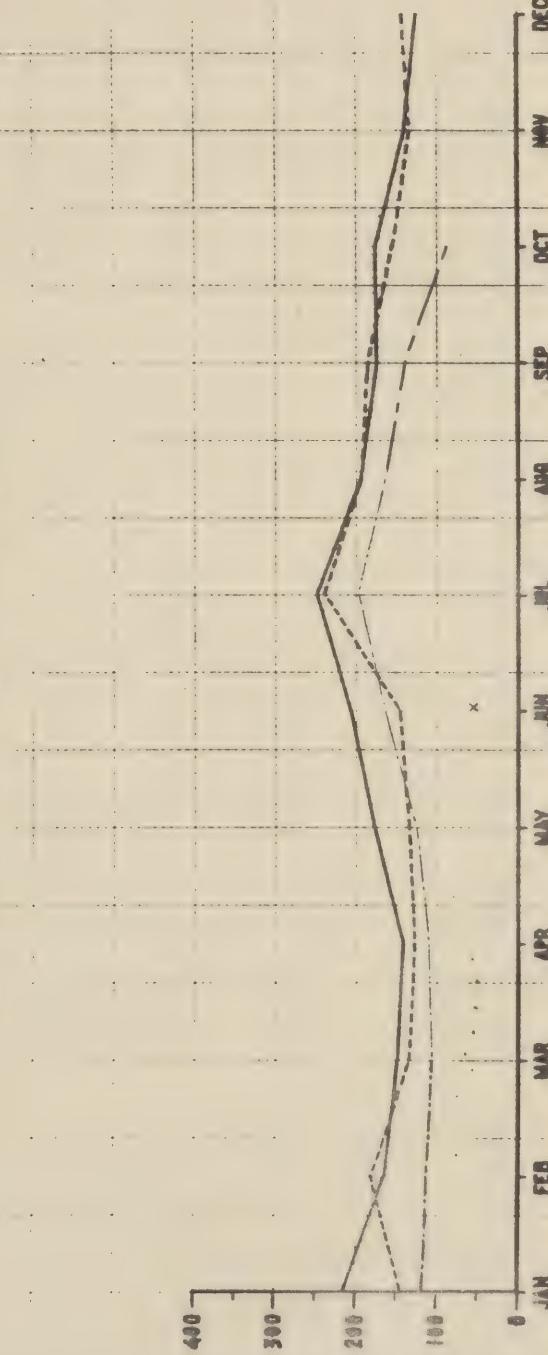
CHART XVII

COMMON RESPIRATORY DISEASE

(INCLUDING INFLUENZA)

ADMISSION RATE PER 1000 PER ANNUM

U. S. ARMY - G.B.I. & I.B. THEATER



LEGEND

- 1943 (G.B.I.)
- - - 1944 (JAN-OCT, G.B.I.
NOV-DEC, I.B.T.)
- 1945 (I.B.T.)

Date from monthly 86 abz.

Data from weekly 86 abz
Starting 1 June 1945

HEADQUARTERS SERVICES OF SUPPLY
U.S. FORCES INDIA BURMA THEATER
OFFICE OF THE SURGEON

ADMISSION RATE PER 1000 PER
ANNUM COMMON RESPIRATORY
DISEASE.

SUBMITTED

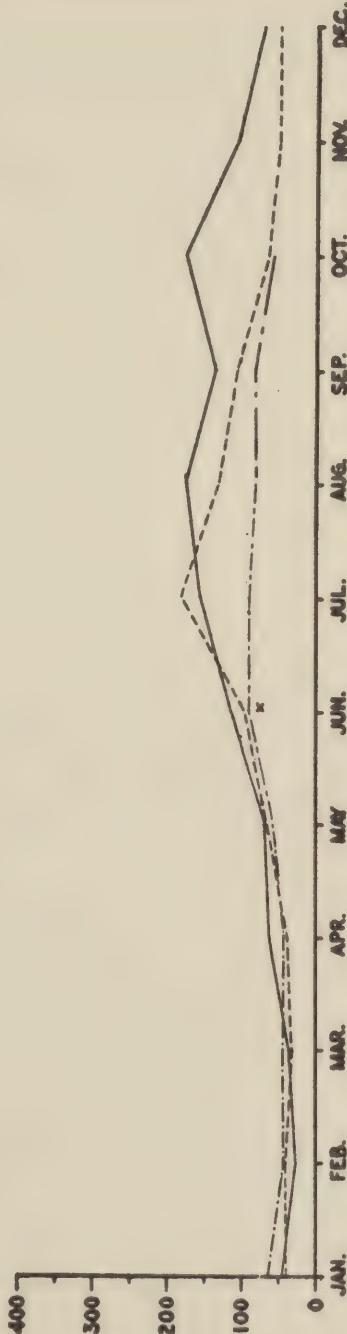
APPROVED

DATE

UNDIAGNOSED FEVER

ADMISSION RATE PER 1000 PER ANNUM

U.S. ARMY C.B.I. & I.B. THEATER



HEADQUARTERS U.S. FORCES I.B.T.
OFFICE OF THE SURGEON
ADMISSION RATE PER 1000 PER ANNUM: UNDIAGNOSED FEVER
SUBMITTED
APPROVED
DATE

x Data from weekly radiographic reports starting 1 Jun 1945

TABLE XI

Comparison of admission rates and numerical reduction in admissions for major causes of disease, July 1945 over July 1944, India-Burma Theater.

Disease	Percent reduction in disease rates	Numerical reduction in admissions per 1000 men
Diarrhea and dysentery	58.5	14.3
Colds, influenza, etc.	22	4.6
Malaria	92	20.0
Fever, undiagnosed	42	5.4
Venereal disease	20	0.9
Dengue	36	1.9
Sandfly fever	76	1.7

The extent to which the reduction in malaria incidence exceeds the reduction in other disease can be attributed largely to the enforcement of atabrine suppressive therapy in the areas of greatest exposure to this disease. The reduction in undiagnosed fever follows in general the reduction of the diagnosed fevers - malaria, dengue, and sandfly fever.

There is no doubt that extensive troop movements into or through areas previously unsanitized are reflected immediately by increased disease rates. Because of the nature of warfare, combat troops and advance service troops must precede other elements and therefore have little protection from disease. When such action ceases and a Theater of Operations becomes static, health measures can be enforced and sanitary supplies made freely available for all troops. The general improvement in the health of India-Burma Theater can be attributed to such changes in operational status.

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HISTORY
OF
RESTAURANT SANITATION
IN THE
CALCUTTA AREA

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HISTORY OF RESTAURANT SANITATION

IN THE CALCUTTA AREA

INTRODUCTION

U.S. Troops in Calcutta

When Japanese victories in 1942 closed the old Burma Road, geographical conditions made Calcutta the principal supply base for construction of the new Ledo Road and later for furnishing supplies and other military aid to China. With consent of the British, U.S. Troops began arriving early in 1943, by mid-summer there were about 2500 SOS, AAF, and ATC soldiers living in the Calcutta Area. This USF population increased to 16,500 by July 1944 and to 24,500 by July 1945. After V-J Day and during the months of September, October and November 1945, while China and Burma units were being evacuated the American population stayed at about 23,000. These strength figures included organizations living within twenty miles of Calcutta; places like Dum Dum, Barrackpore, Budge Budge, Howrah and Tollygunge as these units used the city as a recreational center.

In addition to permanently stationed troops there was a constant flow of casualties through the base. Calcutta became the leave center of the IBT. Railway (RTO) and Airport records showed an average daily movement of over 500 soldiers. Definite figures concerning the number of British (white) troops were not available, it was estimated that they equaled or slightly outnumbered the American population.

ENVIRONMENTAL SANITATION

Geography and Climate

Calcutta sits on flat land, 22 feet above sea level, 80 miles up the Hooghly River from the Bay of Bengal, and at latitude 22 degrees north.

Its climate is semi-tropical; from March through October it is hot and enervating. The winter months however are delightful. Tabular data on climate for years 1934 through 1944 is presented as follows:¹

Period of Year	Temperatures ²			Relative Humidity		
	Average of			Average of		
	Daily Highs	Daily Lows	Mean	Daily Highs	Daily Lows	Mean
Nov. thru Feb.	80	58	69	84	56	70
Mar. thru June	94	80	87	81	60	71
Jul. thru Oct.	89	77	83	88	79	84

Average Rainfall

October through May (8 months)	15 inches
June through Sept. (4 months)	47 inches
Total Yearly Rainfall	<u>62</u> inches

The population of Calcutta increased from 2,410,000 in 1941 to over 2,500,000 in 1945.³ Howrah, across the river had a population of around 1,500,000 in 1945.

Health Statistics

Calcutta's death rate from all causes for the years 1938 to 1945 averaged 100 per day.⁴ Cholera, Smallpox and Malaria were endemic with death rates up to 50 per day during epidemics.

The average life expectancy for residents of the province of Bengal, of which Calcutta is the chief city, was 27 years.

Sanitary Conditions - General

Much has been written about insanitary conditions in India, and Calcutta during the war years of 1944 and 1945 lived up to her reputation of being the filthiest large city in the world.

Housing

An estimated one-half of Calcutta's population lived in "Bustees", poverty stricken areas of primitive, basha and clay walled buildings with mud floors and straw thatched roofs, all densely crowded together and served by narrow, crooked, filth strewn alleyways. Here, large families lived in one room, their latrine was the adjacent gutter, usually choked with muck and sewage and their drinking water supplied from community wells. Bathing and washing of clothes was done in nearby tanks or ponds, the same tanks that received the sewage from the gutters.

The remaining millions of Calcutta's population, the British, Eurasians, and higher Indians lived in houses or apartments and worked in an environment that with certain exceptions compared with those found in the average European city before the war. These exceptions were those due to the influence of ancient habits and customs of old India.

Water Supply

Two separate water systems served Calcutta, one filtered the other unfiltered.

Water for the filtered system was pumped from the Hooghly River some 18 miles north of the city, at the "Pulta" water works. It first passed through a series of settling basins and then through slow sand filters. After filtration a chlorine dosage of about 2.0 ppm was added, this was controlled so as to leave 0.015 ppm of residual chlorine after thirty minute contact. The water was then pumped twelve miles via three large mains into a system of elevated and ground level reservoirs located at "Tallah", at the northern outskirts of Calcutta. From here the water was fed into the city distribution system, by gravity from the 90 feet high elevated storage tanks, and by pressure pumps from the ground reservoirs. More chlorine was added at the Tallah plant and the water entered the distribution system with a chlorine residual of 0.015 ppm.

The filtration plant could produce about 75,000,000 US gallons per day for an estimated population of 2,500,000 or at the rate of 30 gallons per person per day. The demand for filtered water was much greater than the plant could supply. To conserve water, the Corporation operated its valves and pumps, so as to keep high pressure (approx. 40 lbs) in the distribution mains only during mornings and evenings. Theoretically a certain amount of pressure (8 lbs) was maintained in the distribution lines during the rest of the day by means of low pressure pumps. In reality, leakage and the many miles of lines, absorbed this pressure long before it reached the areas served.

The two principal "health hazard" defects of Calcutta's filtered water system were: first, the danger of contamination from back seepage during periods of no pressure and secondly, inadequate chlorination. Instead of having a slight amount of free chlorine in it, the water delivered to downtown and southern residential areas actually had a chlorine demand that was tested many times by U.S. Army personnel as over 0.5 ppm. Numerous bacteriological tests of Calcutta's filtered water were made by the U.S. Army Hospital Laboratory during the past three years.

Available records show that 23 out of 77 samples (30%) examined were non-potable due to presence of intestinal type organisms.

Calcutta's unfiltered water was pumped from the Hooghly River at two points. The Mullick Ghat Pumping Station near the Howrah Bridge supplied North, East and downtown areas. The Watgunge Pumping Station down stream about four miles supplied the southern section. The water was pumped direct into the system by means of pressure pumps, which kept approximately 40 pounds pressure in the mains at all times of day. The Mullick Ghat Station pumped about 60,000,000 US gallons per day, the other one 18,000,000 gallons. This unfiltered water was used for flushing of toilets, fire protection, washing down pavements, dhobie laundries, and other general purposes.

Lack of sufficient filtered water caused many down town buildings, hotels, apartments and homes to install their own tube wells in order to supplement or entirely supplant the city supply. These buildings usually had ground tanks for collection and storage of water from which it was pumped into roof tanks for distribution through the plumbing system. The presence of two, sometimes three, water systems in one building, caused confusion, and liability of cross connection in the plumbing arrangements, this made another great health hazard.

Sewage Disposal

Approximately half of Calcutta's incorporated area of 30 square miles was served by underground drainage and sewer mains. In a 1942 report of the city health department, it is stated that, 43,228 houses were then equipped with flush type toilets connected to the sewer system, while in the unsewered areas 40,487 houses were equipped with pail latrines. Two hundred carts were used for removal of night soil to two large depositories, where the contents were flushed into the water borne sewage system. There were 89 miles of underground brick sewers, 283 miles of sewer pipe and 346 miles of concrete or brick "open gutter" sewers in service at that time.

There were two sewage and drainage systems, the town system and the suburban. The former served the area bounded by the Hooghly River on the West, Circular Canal on the North East, and Lower Circular Road on the West. The main sewers of the town system gravitated to the pumping station at the Palmer Bazaar, while the suburban system, serving the areas South of Lower Circular Road, gravitated to the Ballygunge Pump House. At both pump houses the sewage was lifted to a height of about 15 feet and then flowed through high level sewers, to unite at a place on the southern

outskirts of the city called Topsia. From this point the combined sewage and storm water flowed in an open channel to Bantala, about five miles farther south, where it emptied into two circular, continuous flow type pre-settlement tanks, each having automatic arrangements for removal of sludge. There was a retention period of about 1-1/2 hours in these tanks. Here about 85 percent of the solids were settled out and transferred mechanically to digestion tanks. The effluent from the pre-settlement tanks flowed some 17 miles east, through open channels into the River Kulti, then 70 miles or so into the Bay of Bengal. The sewage plant at Bantala and the channels from there to the sea were in sparsely inhabited territory. To summarize the defects of this drainage-sewage system:

- (1) The 346 miles of open drain and sewage gutters provided reservoirs for transmission of infectious diseases and for fly and other insect breeding.
- (2) The 40,487 pail latrines left excreta, exposed to flies for long periods.
- (3) The main sewers were too small; during monsoon seasons, when several inches of rainfall fell in a short time the low lying streets would be filled one to two feet deep with storm water and sewage from higher levels.

Garbage Disposal

During the war years the Calcutta Corporation (City) garbage collection department suffered periodic breakdowns. During these periods the garbage went uncollected for days, and sometimes weeks. This was attributed to lack of trucks. The great majority of garbage cans (dust bins) were owned by the Corporation. It was their practice to place these dust bins for the convenience of their collecting trucks. Therefore, many of them were located along the main thoroughfares, in front of the fashionable hotels and stores of downtown Calcutta, near wealthy residences, in front of the stately Government House, as well as in the Indian markets and Bustee areas. During the periodic breakdowns of the collecting system the dust bins were of little use, and served more as a center for the garbage pile than as containers. A great many were badly damaged, had no covers and the garbage spilled over on to the surrounding ground. Cattle, dogs, crows, and destitute human scavengers searched through these garbage dumps in tropical heat and dust, and flies bred and fed.

At these times downtown Calcutta competed with the squalid alley-ways of the Bustees for the largest and most odorous accumulations of garbage.

Normally the garbage was collected between 5 and 8 in the morning, 3 and 5 in the afternoon in special lorries. It was hauled to the Chingrighatta refuse platform rail head located about one half mile south of the Sealdah Railroad Station. Here it was unloaded directly into railway wagons and taken about 17 miles further south to a place called Dhappa where it was dumped into a large salt water wash or lake.

Calcutta's Markets

There were over 50 markets in and around Calcutta, eight run by the Municipality and the others privately owned. The "New Market", by far the best of them, served most of the downtown area. It had many defects. Probably the most unhealthy practice was the general use of unfiltered (Hooghly River) water for almost every purpose, from dhobie laundry work to freshening up green vegetables or cleaning cut meats and sea food. In the meat stalls no effort was ever made to smooth or otherwise sterilize the wooden block used for cutting. Meat left unsold was sprinkled with saltpetre and kept unrefrigerated until the next day when it was washed and ground into sausage.

The one "New Market" latrine was entirely inadequate for the estimated 6000 people working in the 2000 stalls of the market to say nothing of the thousands of daily visitors. As a result the alleys between rows of stalls were soiled day and night.

The approaches to the market place, and those portions of passages and alleys not occupied by transient vendors, were always littered with decomposed leaves, straw, and discarded fruit or vegetables. The drainage gutters, blocked with refuse, added to the litter and stench. All stalls were unscreened during the hot season, clouds of flies divided their attention between piles of rotting vegetables and the fish and meat offered for sale. Small fish and prawns (shrimp) were stocked for sale in large quantities, however, about half the time it was not available. It was claimed by restaurant proprietors that 15 to 20 percent of all prawns bought at the New Market had to be discarded because of being stale. It is believed that much of the illness reported by soldiers, after eating prawns was due to the restaurant keepers' reluctance to throw away such a large portion of their purchase.

Another unhealthy practice was the sale of over-ripe fruit and vegetables by street vendors. These vendors would cut out the over-ripe portions as best they could and display the cut fruit at street corners for sale to the poorer people. Sweet-meats and other ready to eat items were prepared in improvised shelters within the market for consumption by the stall holders. In observed cases, this was being done in poultry pens.

Of the two hundred and twenty four (224) samples of milk taken from wholesale markets, street vendors and other dealers in downtown Calcutta, during April and May 1945, and analyzed by the Calcutta Corporation Laboratory, one hundred and fifty one (151) were found to be adulterated, the adulteration in some cases being more than 86 percent.⁵ The chemical and bacteriological tests on these samples were extremely unsatisfactory. In all adulterated samples E-Coli organisms were found, suggesting that unfiltered Hooghly River water was used for the dilution.

Calcutta's Restaurants

Like all boom towns, Calcutta was ill prepared to house or feed the thousands of soldiers that came. Before the war there were comparatively few public eating places in Calcutta patronized by British and Europeans. These were the Great Eastern, the Grand, Firpos, Ferrozinnis and three or four others along Chowringhee Road. With the arrival of British and U.S. troops in 1942 and 1943 many more restaurants were opened in the downtown area. About half of these new restaurants were operated by Chinese refugees from China East Coast cities of Hong Kong, Canton and Shanghai. In early 1944 there were over 100 restaurants catering to allied troops. By 1945 this number had been cut down to around 50 through joint control action of the British and U.S. Medical Departments.

The Americans found hygienic standards in Calcutta civilian eating places very bad. The Indian ritual of cleansing with water by hand after defecation assured that the hands, and frequently the bare feet of every Indian food handler would be contaminated with fecal material most of the time. The ancient Indian caste system required that the bearer cook and serve the food. The proprietor of the average cafe was much too superior to be concerned with direct supervision of his kitchen, so that one rupee per day cooks and bearers carried on in the kitchen as they pleased.

The old established eating places were soon swamped with

trade and trying desperately to handle three times the business that they were equipped for. New restaurants opened (with improvised equipment) in any quarters they could find. In some cases they were found preparing and cooking food, washing dishes, pots and pans in the same alley ways they used for their latrines at the back door of their establishments. Only a few had any sort of toilet facilities for their employees. There was invariably extreme unwillingness on the part of the proprietors to spend any money on hygienic improvements.

The following is excerpted from an Army Report (The Kelser Mission) dated 9 November 1945.⁶

"33. There is no doubt that eating in civilian restaurants ranks with improperly treated water and employment of native food handlers as a cause of acute disease among our troops. This is particularly true in Calcutta where large numbers of transients and permanently assigned personnel are found.

34. Calcutta's eating places are notoriously bad..... A detailed inspection was made of the kitchens of the Great Eastern Hotel, the Grand Hotel and six or eight popular restaurants on Chowringhee Road; apart from the first mentioned hotel, sanitary conditions in the kitchens of these representative restaurants are abominable. The filth, confusion and smells are so bad that it is unbelievable that any ordinary American would eat food served from such sources if he were aware of back stage conditions. It is unnecessary to enumerate specific sanitary defects in these places. Everything is bad, from inadequate refrigeration to dish washing.....

35. There is general agreement among C. B. I. Line and Medical Officers that a great deal of the diarrhea and dysentery suffered by our personnel is acquired in such civilian restaurants. The problem is extremely complex and cannot be settled by declaring such places out of bounds, since troops on leave and in transit through the city will gain access to tasty native and Chinese food in spite of military regulations.

36. Unfortunately the problem is too great to be solved by a few inspectors, even though they are armed with adequate powers to place any establishment out of bounds. Native eating places cannot be brought up to occidental standards of cleanliness. To attempt to do so would simply result in placarding all restaurants out of bounds and create a hopeless morale and police problem for military authorities."

ARMY EFFORTS TO CONTROL RESTAURANT SANITATION

Formation of the Allied Hygiene Committee (AHC)

For political reasons as well as due to lack of U.S. Medical Department and Military Police personnel it was obvious from the beginning that any attempt to control restaurant sanitation must be a joint undertaking by British and Americans. It is not known whether the British or the Americans initiated the original Allied Hygiene Committee. No records of its inception could be found and all of the old members had left Calcutta a year or more before this was written. There was nothing in the files of either the British DADH (District Administrator Department of Hygiene) or the U.S. Base Surgeon's Office to indicate that special written orders were published. The oldest document found was a record of the minutes of a meeting of the AHC dated 10 February 1944. There were four British members and one American present at this meeting.

Growth of the AHC

U.S. contribution to the work of the AHC was at first restricted by lack of Medical Department personnel. From late 1943 until November 1944 the U.S. Army was represented by the Base Medical Inspector and by the Base Provost Marshal. During this time the British had a medical officer from each service (Army and RAF) as well as their Area Provost Marshal on the committee. With gradual expansion of the U.S. Base Surgeon's Office more medical department officers became available and in November 1944 the Base Sanitary Engineer was assigned to assist in this work. The working committee then consisted of:

British: The Area Provost Marshal and four medical officers.

U.S. : The Base Provost Marshal and two medical department officers.

The personnel of the committee changed frequently as officers were transferred in and out of Calcutta.

Development of Policies and Procedures

In the beginning each inspecting officer worked more or less according to his own ideas and schedule. General policies gradually assumed more definite shape as the experiences of the members gave them a background for judgment. The essential

functions of the Medical and Provost Departments were recognized from the first, namely:

- (1) It was the function of medical representatives to inspect as to hygiene and make recommendations as to whether the place should be "In Bounds" or "Out of Bounds" to allied troops.
- (2) It was the function of the Military Police Departments to execute and enforce the "Out of Bounds" rulings.

The technical working procedures also went through a series of evolutions during 1944 and 1945. By midsummer 1945 the following policies and procedures were in effect:

- (1) The AHC met on the first Tuesday of each month to review past work and plan for the future.
- (2) For convenience in making inspections the "In Bounds" area of Calcutta was divided into six zones, a schedule was devised whereby each restaurant was inspected twice every month by a medical member.
- (3) Each restaurant kept a sanitary diary in which the Inspecting Officer noted his findings. Typed reports of each inspection were submitted to the two Provost Marshals, also copies to the other members. At the end of each report appeared one of the following notations:
 - (a) Warning - not satisfactory, will reinspect in one week.
 - (b) Recommend place "Out of Bounds".
 - (c) Recommend continue "In Bounds" or "Out of Bounds".
 - (d) Recommend place back "In Bounds".
- (4) When "Out of Bounds" recommendation was made, the two Provost Marshals were advised by phone so that immediate action could be taken. In order to obtain results the minimum time for a

place to remain "Out of Bounds" was set at two weeks. At the end of this time the establishment was reinspected by the Officer who had made the original "Out of Bounds" recommendation. If not yet satisfactory, it was continued "Out of Bounds" for three more months, then reinspected only on special request from the proprietor.

- (5) The Military Police work of posting "Out of Bounds" sign boards etc., was done by the British APM.
- (6) Each inspecting officer was accompanied by an NCO from his own office to record notes and otherwise assist in the inspection.

RESUME OF THE ACTIVITIES - 1944-1945

The Restaurant Code (Rules of Hygiene)

The British DADH in September 1944 had published a one page memorandum on "Food Restrictions for Military Personnel" which was circulated among the hotels and cafes, a copy of this is attached as Incl. No. 1.

In early February 1945 at the suggestion of Lt. Col. K. R. Flamm, then U.S. Base Surgeon, a more elaborate set of "Rules of Hygiene for Public Eating Places" was adopted and distributed by the committee to serve as a guide for both the restaurants and the inspecting officers. This set of rules was revised twice during 1945 to cope with changing conditions. The final revised edition (October 1945) is attached as Incl. No. 2.

The Great Eastern Hotel

In early 1944 most of U.S. Hq. Base Section #2 Officers as well as transient officers and enlisted men were billeted and ate at the Great Eastern Hotel. This hotel, originally intended to accommodate 350 people, was occupied by over 300 U.S. Army personnel in addition to 200 British troops and civilians. Dining room and kitchen facilities were entirely inadequate. There were frequent cases of diarrhea among the U.S. personnel. After numerous inspections and attempts to correct the insanitary practices had failed, it was decided that drastic measures must be applied. At the insistence of the Allied Hygiene Committee and despite much pressure and opposition from both civilian and

Army sources, the Great Eastern Hotel dining room and kitchen were placed "Out of Bounds" on 17 April 1944. It remained out until 5 June 1944 and was permitted back "In Bounds" only after kitchen and food storage rooms had been completely rebuilt, re-equipped and the staff reorganized, so as to make certain members responsible for maintenance of sanitary standards and procedures. AHC inspections and US diarrheal records since 5 June 1944 indicate that the Great Eastern Hotel became one of the safest eating places in downtown Calcutta.

The Cholera Epidemic

Cholera was more or less endemic among civilians in Calcutta, its average since 1940 had been 15 attacks and 5 deaths daily. The disease assumed epidemic proportions in February 1945. During the height of the epidemic an average of 100 people were stricken with 35 deaths daily. The epidemic continued through March, April, May and into the first part of June. Corporation mortality figures show over 3500 attacks and more than 1200 deaths during this period.

There were many transmitting agents for the disease as indicated by the section of this report dealing with the environmental sanitation of Calcutta. The food handling habits, accumulation of garbage and filth on the streets, unchlorinated water supplies and primitive sewage disposal facilities undoubtedly were major causes.

Medical Department action had to be and was taken to protect the 24,500 U. S. troops in and around Calcutta. The history of the Base Section will show what was done among the U. S. Army installations proper. The Allied Hygiene Committee stepped up its activities. Restaurant inspections became more frequent and strict. A letter was circulated directing attention to the causes and control of cholera - copy attached as Incl. No. 3. The AHC rules of hygiene were revised to incorporate special control measures against cholera. The principle points covered by the revision were:

- (1) Restaurants were compelled to have all their employees immunized against cholera.
- (2) Emphasis placed on serving only hot cooked foods.
- (3) Emphasis on sterilization of drinking water.
- (4) Emphasis on non use of ice in drinks.

A Medical Department NCO of the Base Surgeon's Office was assigned to inspect each "In Bound" restaurant once a week and to maintain a special chart record of violations of AHC rules. This chart became an indicator by which the AHC was enabled to direct more frequent inspections at the worst offenders. A copy of the chart used, is attached as Incl. No. 4.

To enforce the AHC rules it became necessary to put many restaurants "Out of Bounds", some permanently, others for varying periods of time. The records for March, April, and May show 41 restaurants put "Out of Bounds", 15 of them permanently. The others were allowed back "In Bounds" only after installations of proper dish washing facilities and other sanitary improvements and upon condition that former improper practices were rectified.

The nearest contact to the cholera epidemic for U.S. troops was on 20 April 1945 when several cases of cholera were reported among British military personnel billeted in the Grand Hotel. This hotel had always been the principal billet for transient British officers. Its normal peace time accommodations were for 300, during the war years it averaged 750 British and up to 150 Americans.

The Grand Hotel had long been a sore spot with the AHC because of crowded conditions, poor food and lack of hygiene, but because the billet was necessary and none other was available, except worse ones, it remained "In Bounds".

Finally, a Joint AHC inspection of the Grand was made 10 January 1945 with the intention of placing it "Out of Bounds". However, at this inspection the place was unexpectedly found clean. Also at this inspection British members who were formerly in favor of putting it out had changed their minds.

On the day that the first cholera case was reported from the Grand Hotel the 135 U.S. officers then quartered there were moved out. The British, having no other billets available, left their troops at the Grand but placed the dining room and hotel night club "Out of Bounds". The hotel then made extensive reforms in the operation of its kitchen including installation of additional water heating facilities, a water chlorinating system, lavatories for cooks and bearers and a medical survey of the 1700 employees. In this connection it was reported that twenty-one mild cases of cholera were brought to light.⁷

The British also installed a medical officer at the hotel with a staff of Hygiene Department BORs to supervise the

various food handling operations, chlorination of water, immunization of employees, etc.

The British put the Grand Hotel dining room back "In Bounds" to their troops 27 April. A month later, 29 May, on special request of the U. S. billeting officer the Americans made a formal inspection of the Grand, reviewed the new sanitary control measures with the British resident medical officer and sanctioned its return to "In Bounds" to U. S. troops.

The final statistics on incidence of cholera among British Military personnel are as follows:⁷

14	British officers billeted at the Grand
3	BORs stationed and billeted in Calcutta
2	WACI's " " " " "
8	Indian soldiers stationed and billeted in Calcutta
<u>27</u>	Cases, 2 Deaths

On 23 April, immediately after the report of cholera at the Grant Hotel, it was decided to make military personnel aware of the epidemic as forcibly as possible and to disseminate information as to ways of avoiding it. This program was started immediately, it consisted of distributing thousands of stickers, posters, handbills, and making radio broadcasts four times a day about cholera. The details of this campaign are enumerated in the history of the Base Section. The idea was seriously considered for a while of placing all of Calcutta public eating places "Out of Bounds" to U. S. troops during the cholera epidemic. However, this was not done because of obvious administrative and military police duties involved plus the desire to maintain all of the good will and cooperative efforts achieved with proprietors.

There was no case of cholera among U. S. troops in the Calcutta area during the epidemic period. It should here be noted that periodic immunization against cholera is not mandatory in the British Army as it is for American Forces in the Asiatic Theater.

Chlorination of Drinking Water in Restaurants

In early June 1945, as directed by Circular No. 57, Hqs., USF, IBT, APO 885, 24 May 1945, a copy of which is attached as Incl. No. 5, arrangements were made so that civilian restaurants could purchase chlorine ampules from the local U. S. Q. M. sales store. At the same time an AHC directive was circulated advising "In Bound" restaurant proprietors that they would have to

chlorinate their drinking water. Copies of these are attached as Incls. No. 6, 7 and 8. To implement the directive, a U.S. Medical Department N.C.O. was assigned to duty of patrolling the restaurants daily to check on and assist with the drinking water chlorination.

The daily chlorine test records and laboratory bacteriological reports, on spot samples taken each week from various restaurants were found very satisfactory. Fourteen out of the fifteen water samples examined July through October 1945 were potable bacteriologically.

Control of Soda Water Plants

Weekly laboratory analysis of representative samples of soda was inaugurated in February and March 1945. The results showed that approximately half the samples were bad. It was found that there were many contributing reasons, among which was the use of the city water supply without further purification.

All but one soda water plant were put "Out of Bounds" in March. Four of these were allowed back "In Bounds" in April and May after improvements of equipment and bottle washing procedures made them satisfactory. Arrangements were made for purchase of the chlorine by soda water plant owners through the U.S.Q.M. sales store. See copy of letters attached as Incls. 9 and 10. A Medical Department N.C.O. was assigned the duty of visiting the "In Bounds" soda water plants daily to check chlorination of water and other hygienic measures such as bottle washing, and to collect spot samples for laboratory analysis.

Laboratory reports on 117 samples of soda water analyzed since May 1945 show 113 good, 4 bad.

Control of Ice Cream

Attempts to control the quality of ice cream served in Calcutta restaurants started rather late in 1945. U.S. Army camps were supplied from the only ice cream plant in Calcutta, the Magnolia. Stateside ingredients were used for the Army issue, but the work of mixing and freezing was done at the Magnolia plant under U.S. Q.M.C. N.C.O. supervision. Weekly samples were examined at the Army laboratory. About 85 percent passed stateside standards.

Magnolia, using Indian dairy products also produced ice cream for sale to local eating places. The demand was greater than it could supply. As a result many restaurants made their own ice cream. A laboratory survey of the products made by the restaurants was made in August and September 1945. It was revealed that over 40 percent of this ice cream had a higher colony count than U. S. Army standards permitted. Many showed coli organisms. As a result of this survey, an ice cream code was prepared and issued by the Allied Hygiene Committee in October 1945. A copy of this code is attached as Incls. No. 11 and 12.

Results of Allied Hygiene Committee Activities

In an attempt to obtain approximate statistical comparisons, a canvass of all "In Bounds" civilian restaurants, including hotels and night clubs, was made during October 1945. Each place was questioned as to the number of meals served daily. From the tabulated answers it is estimated that around 7200 meals were being eaten daily by U. S. Army personnel. To make further comparisons, the U. S. Army Central Dispensary in Calcutta was consulted. This dispensary had compiled records of all cases of diarrhea treated at all dispensaries in the Calcutta area between 18 June and 12 August 1945 (56 days). According to its record 329 cases had been reported and treated; 78 of these were suspected as having originated from forty-three civilian eating places, the remainder from twenty-three Army camp and Red Cross messes.

Using the civilian restaurant figures of 78 cases in 56 days and (7200 meals) or 2400 men per day the rate per 1000 per year would be 212. This is purely an estimated rate. The Base Section diarrhea-dysentery rate for this period was 150 and for the India-Burma Theater 125. Base Section rates for the same period in 1944 was 322, for the India-Burma Theater 264. It is believed that improved restaurant sanitation may have contributed toward the lower rates of 1945.

Cooperation with the British

There was at all times complete unity of purpose within the Allied Hygiene Committee during the two and a half years of its existence. Minor differences arose over policies and execution but in all cases these were ironed out at the committee meetings.

The British and American provost marshals were most cooperative in taking immediate action on recommendations by the medical inspecting officer. With exception of the Grand Hotel incident, there was never any questions or hesitation about putting a place out of bounds, nor was there any dissension among the

Medical Department members over the judgment and recommendation of any inspector. The U.S. members were possibly more aggressive in initiating new rules. There were times when pressure was applied from the outside to keep certain restaurants "In Bounds" despite recommendations to the contrary by the medical inspecting officer. In each case the party under pressure received the full support and backing by the others.

Conclusions

Conclusions are that restaurant sanitation in Calcutta can be improved by the judicious application of education and force. It is hoped that some of the educational work done by the Allied Hygiene Committee will continue after its departure.

CALCUTTA,
15 November 1945.

Incls: 12.

C O P Y

H.Q., 303 L of C Sub Area Med
C/o No. 12 A.B.P.O.
2nd September 1944.

TO:

All Hotels, Restaurants, Cafes, Boarding Houses Etc.

Subject: FOOD SUPPLIES TO MILITARY PERSONNEL.

Certain stipulations are laid down with regard to food and drink consumed by military personnel. Such of these as affect personnel taking meals, refreshments, etc., in your establishments are forwarded herewith for information.

/s/ R. J. Thomson,
/t/ R. J. Thomson,
Major, R. A. M. C.
D. A. D. H.

RTT/GS

FOOD RESTRICTIONS FOR MILITARY PERSONNEL.

1. VEGETABLES: No vegetables will be served uncooked.
2. FRUIT: The following types of uncooked fruit are prohibited:-
Melon, Watermelon.
3. MILK: All milk will be boiled before use.
4. WATER: All water other than from a piped water supply will be boiled before drinking.
5. HAM & BACON: Ham will be thoroughly cooked, and particular attention paid to ensure that portions near the bone are not raw.
Where facilities for cooking entire ham are not available, they will be cut into thin slices before cooking.
Bacon will be cut into thin slices, and well cooked.

Incl. No. 1



CALCUTTA BUSTEE
APRIL 1945



CALCUTTA BUSTEE
APRIL 1945



CALCUTTA BUSTEE
APRIL 1945



DOWNTOWN CALCUTTA
APRIL 1945



FREE SCHOOL STREET
APRIL 1945



KYD STREET, OFF CHOWRINGHEE
April 1945



INDIAN FRUIT MARKET IN BURRABAZAR
APRIL 1945



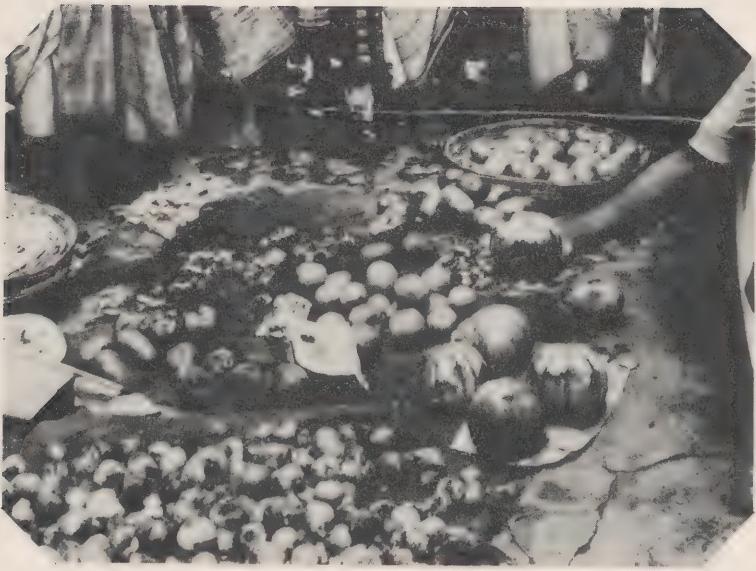
FRONT OF INDIAN HOTEL IN BURRABAZAR
APRIL 1945



AT THE FRONT OF A RESTAURANT
CENTRAL AVENUE, SOUTH
APRIL 1945



ON HARRISON ROAD
APRIL 1945



ROTTING FRUIT FOR SALE - NEW MARKET
APRIL 1945



CUT FRUIT FOR SALE - FAIRLIE PLACE
APRIL 1945



DHARAMTALA STREET AND CHOWRINGHEE - 23 APRIL 1945
A GUTTERSIDE GARBAGE HEAP AND CUT FRUIT FOR SALE



STREET SCENE - 23 APRIL 1945 - SOFT DRINKS FOR SALE
THE GLASSES WERE RINSED IN THE BUCKET AFTER EACH USE



SELLING CUT MELONS ON A DUSTY STREET CORNER
APRIL 1945



CENTRAL AVENUE, SOUTH - 23 APRIL 1945
DRINKING TEA ON THE CURBSIDE

SANITARY DIARY

For permanent record of the comments of Inspecting Medical Officers and Military Police Officers, a note book will be provided and kept at all times on the premises.

This will be produced on request by such Officers.

Certified True Copy.

/s/ DONALD C. TEAL
/t/ DONALD C. TEAL
Capt., Sn-C.

Incl. No. 1

THE ALLIED HYGIENE COMMITTEE
OFFICE OF THE A.P.M.

303 Area,
Calcutta, India

10 October 1945.

TO: All Public Eating Places Desiring to be
"In Bounds to Allied Military Personnel".

1. Changing conditions have made necessary a complete revision of the "Rules of Hygiene for Public Eating Places" published by this Committee. A copy of the new, revised Rules is attached. They will be studied carefully by proprietors of all Public Eating Places desiring to be "In Bounds" to Allied Military Personnel, and all provisions will be complied with at once.

2. Inspections of Public Eating Places by members of this Committee will be more frequent in the future and Rules will be rigidly enforced.

Incl. No. 2

THE ALLIED HYGIENE COMMITTEE,
CALCUTTA, INDIA

RULES OF HYGIENE FOR PUBLIC EATING PLACES

Revised October 1945.

The Allied Hygiene Committee is charged with making periodic inspections to decide whether public eating establishments shall be "In Bounds" to military personnel. Any "In Bound" establishment which fails to comply with these rules will be placed "Out of Bounds" to military personnel. The decision of any member of the Committee will be considered official and final.

1. Employees:

a. Must be in good health free from disease, and skin, respiratory and intestinal disorders.

b. Immunization: New employees, before starting to work, as well as old employees, will have the following immunizations, within the time specified:

- (1) Smallpox vaccination - 2 years
- (2) Typhoid inoculation - 1 year
- (3) Cholera inoculation - 6 months
- (4) Record of these three inoculations will be maintained by the employer in a separate notebook using the following form

:	:	DATES OF LAST INOCULATION			:
:	:				:
:	:	SMALLPOX	TYPHOID	CHOLERA	:
:	EMPLOYEE'S NAME				
:	Ali Kahn	: Jan 5, 1945	: Jan 5, 1945	: June 11, 1945	:
:					:

- (5) A certificate by a registered physician showing the name of the employee immunized, and the type and date of immunization must be available to verify the above record. All certificates will be kept in one file.

c. Must be clean of person, have finger-nails clipped short, and hair trimmed. All clothing including head-gear must be clean.

d. Must have clean habits and make to:

- (1) Scrub hands, using soap and water and nail-brush, before handling food. Facilities for washing hands other than in the kitchen sink will be required at the large establishments.
- (2) Wash hands after visiting the toilet.
- (3) Avoid touching any food or drink or touching any object or surface which may come in contact with food, particularly the inner surfaces of food containers.

e. Will not smoke in kitchens and will avoid coughing or expectorating on premises.

f. Employers must provide toilet facilities for use by employees. Toilets must be clean, flyproof and free from odors.

2. Dining Rooms:

a. Must be ventilated, and well lighted, clean and bright.

b. Must be kept free from flies, cockroaches, ants, rats, mice and other vermin. If necessary they will be fly-proofed.

c. Must show evidence of frequent and thorough cleaning of floors, walls, ceiling, tables, fans and other equipment and fixtures.

d. Table linen, if used, must be changed frequently.

e. Condiments and spices must be kept fresh and in clean containers.

f. No attempt shall be made to serve more people in the dining room than the kitchen facilities can handle adequately.

3. Kitchens:

a. Must be well ventilated, well lighted, and fly-proofed. Screen doors must be kept closed.

b. Must show evidence of frequent and thorough cleaning of floors, corners, walls, ceiling, shelves and tables.

c. Must be kept free of flies, cockroaches, ants, rats, mice and other vermin.

d. Must present a neat and orderly appearance. Must not be cluttered up with clothing, unused equipment, or other debris. Employees must not change their clothes in the kitchen premises or keep their clothing in the kitchen.

e. Utensils and equipment must be clean and free of grease, and must be stored above the floor under clean conditions.

4. Food Storage:

a. Adequate facilities must be provided for the proper storage of food.

b. Food storage rooms must be clean, fly-proofed and free of flies, cockroaches, ants, rats, mice or other vermin. Food regardless of type or container will not be stored on the floor.

c. Dry storage items, such as sugar, coffee, flour, beans, rice, etc., must be kept in clean containers (preferably galvanized cans or wood bins lined with metal), and protected from dust, dirt, insects and rodents. Fruit and vegetables must be stored above the floor in dry ventilated containers.

d. Bread, pies and cakes will be kept in clean (fly-proofed) ventilated containers and protected from insects and rodents. Shelves will not be lined with newspapers. Bare wood shelves, which show evidence of thorough daily scrubbing with soap and hot water, are preferred.

e. Refrigerators and ice boxes must be clean and free of odors.

f. The following foods will be kept in cold storage: meats, fish, dairy products, custards, and puddings. Only raw foods will be allowed to come in direct contact with ice. Prepared foods, ready to be served without further cooking will be refrigerated with the utmost care to avoid contact with ice or ice water. Prepared foods will be kept separate from raw foods. They will preferably be refrigerated in a mechanical refrigerator or in a compartment separate from ice, and will be protected against dirt, insects and rodents.

g. Plunger type pumps used at fountains for syrups will be cleaned in soap and hot water and boiled in water for five (5) minutes once daily.

5. Preparation of Food and Food restrictions:

- a. Foods will be obtained only from reliable sources approved by the Allied Hygiene Committee.
- b. Foods will be prepared on clean tables in a fly-proofed preparation room. They will not be prepared on the floor.
- c. All meats, fish, seafoods and vegetables will be thoroughly cooked and served HOT to Military Personnel. This means that no salads of any kind will be served. Uncooked tomatoes and onions will not be served. Cooking of meat must be thorough to ensure that portions near the bones are not raw. Where facilities for cooking entire hams or other large pieces of meat are not available, the meat will be cut into portions small enough for thorough cooking.
- d. Raw fruits will not be served to military personnel. They will be cooked thoroughly. Stewed fruits will not be served more than 24 hours after cooking and must be kept in covered containers and otherwise protected from contamination.
- e. Fruit juices will be prepared only from thick-skinned fruits which have been washed and scrubbed with a brush. After fruits, intended for juice, have been scrubbed, they will be stored in clean receptacles and handled the same as any other prepared food. Absolute cleanliness will be observed while extracting juices.

f. Puddings and custards must not be prepared more than two hours in advance of the regular meal time. They must be refrigerated at once and must not be served after they are more than four hours old.

6. Dairy Products:

- a. Milk and Cream - The serving of milk, and beverages containing milk, to military personnel is PROHIBITED except as follows: Milk and cream may be served for use with coffee or tea only after boiling on the premises for at least five (5) minutes. Milk and cream will always be served hot to the customer.
- b. Butter - Butter will be pure and free from rancidity, dirt, adulterants and preservatives. It will be refrigerated in sanitary containers, and handled as a prepared food.

c. Ice Cream. -

- (1) Source - Ice cream served to military personnel will be procured only from manufacturing establishments approved by the Allied Hygiene Committee. Any public eating place desiring to make and serve its own ice cream must apply to the Committee in writing for permission, and must conform to Committee's Rules for the Manufacture of Ice Cream. A copy of these rules will be furnished on request.
- (2) Handling - Ice Cream is a potentially dangerous food and will be handled with great care to prevent any possible contamination. Ice and ice water will not come in contact with ice cream, or the lips, covers and interiors of ice cream containers. When ice cream is received in a restaurant, the outside of the containers will be washed and dried before storage.
- (3) Serving. - Containers of ice cream will be kept covered except when actually removing the contents. The inside of containers, or covers, or the ice cream itself will not be touched. Covers temporarily removed from containers will be placed upside down on a clean surface.
- (4) Scoops will be a commercial type, easy to clean and with a handle long enough to prevent employee's hands from contacting the ice cream. Ice cream will not be removed from scoops with the fingers. Ice cream scoops will be cleaned and maintained as follows:
 - (a) Scoops will be rinsed in a container of drinking water which is changed hourly.
 - (b) After rinsing in drinking water, scoops will be transferred at once to a strong chlorine solution where they will remain when not in use. This strong chlorine solution will be prepared fresh daily by dissolving one ampule of calcium hypochlorite in one quart of water.
 - (c) The handles of scoops will not be submerged in either solution. Ice cream will be dipped by scoops which come directly out of the chlorine solution.

7. Drinking Water:

- a. Sterilization. Only water that has been boiled and/or chlorinated on the premise will be served for drinking. Boiling

(minimum 5 minutes) is required where present methods of storage and handling expose the water to contamination. The chlorination will be done as the last step in water purification. The boiled water must be allowed to cool to room temperature before the chlorine is added, otherwise the chlorine will not stay in the water.

b. Storage and Handling. Water for drinking will be handled in a manner to minimize opportunities for contamination. Storage tanks and containers will be kept clean and completely covered at all times. Dipping of water from reservoirs or containers will be avoided where arrangements can be made that will permit withdrawal of water from taps. Drinking water, other than when obtained through pipes from chlorinated roof tanks, will be chlorinated and stored in a covered container with a tap at the bottom. These containers will be labelled "DRINKING WATER" in letters at least one (1) inch high. All drinking water must be withdrawn from the bottom tap and not by dripping into the containers.

c. Cooling. Ice must not be placed in drinking water for cooling nor will melted ice be served for drinking. The drinking water may be placed in bottles for cooling in ice box or refrigerator but bottles must be stoppered or capped tightly and bottles, stoppers and caps will all be washed and rinsed with boiling hot water prior to use.

d. Serving. The outside of water bottles stored on ice or in ice water, will first be rinsed with clean water, then dried with a clean towel before the contents are poured out.

8. Soda Water and other Beverages.

a. Source. Soda water and other manufactured soft drink beverages will be obtained only from manufacturers approved by the Allied Hygiene Committee. Bottles will be labeled with the manufacturer's name, otherwise they will be considered as coming from an unauthorized source.

b. Cooling and Serving. The rules regarding cooling and serving of drinking water as set forth in Paragraph 7 c and d, will govern cooling and serving of all beverages including cold tea and squashes.

9. Dish-Washing.

a. Facilities must be provided for washing dishes, glassware, and cutlery properly. Minimum requirements are:

- (1) Two or more sinks of adequate size.
- (2) Equipment for boiling water. An adequate supply of boiling hot water must be available at all times when dishes are being washed.
- (3) An ample supply of clean dish towels.

b. The minimum procedure for washing dishes, glassware, and cutlery will be:

- (1) Scrub with brushes in hot soapy water to which soda has been added, in one sink. Use enough soap to make a good lather.
- (2) Rinse in boiling hot water in another sink.
- (3) Dry with clean towel. Towels must be changed frequently, and must not be allowed to come in contact with the clothes or bodies of employees.

c. Washed dishes, glassware, and cutlery must be clean and free of grease or caked food.

d. Washed dishes, glassware, and cutlery will be kept separate from all dirty articles and will be placed on a clean surface pending use. They will not be placed on newspapers.

10. Disposal of Garbage and Waste:

a. There must be adequate provisions made for proper disposal of garbage and kitchen wastes.

b. Garbage cans shall be water-tight and have well fitting lids. They shall be kept clean on the outsides and covered at all times to prevent attracting flies.

c. The area around garbage cans must be kept clean and free from spilled garbage.

d. Garbage cans must be emptied daily or more frequently if necessary to keep from being filled to over-flowing, and shall be scrubbed thoroughly each time they are emptied.

e. Floor scrub water shall be directed into underground drains or mopped up. It must not be swept out of the kitchen door onto the ground outside.

f. Old papers; lumber, and dry rubbish must be burned or carried away daily. It must not be allowed to collect.

11. Menus.

a. All items on the Menu which are prohibited by the above rules must be clearly marked to show that they may not be served to Allied Military Personnel.

12. Sanitary Diary.

a. For permanent record of the comments of inspecting Medical Officers and Military Police Officers a notebook will be provided by the proprietor and kept at all times on the premises. This will be produced on the request of any inspecting officer.

b. These "Rules of Hygiene for Public Eating Places" will be kept with the Sanitary Diary so that inspecting officers may note unsatisfactory conditions by reference to the paragraph covering same.

THE ALLIED HYGIENE COMMITTEE,
CALCUTTA, INDIA.

October 1945.

CALCUTTA, INDIA

24 April 1945.

TO: ALL CAFES AND PUBLIC EATING PLACES "IN BOUNDS" TO ALLIED
MILITARY PERSONNEL

1. Your attention is invited to the fact that the cholera epidemic now prevailing in Calcutta is an intestinal disease transmitted by eating infected food or drinking contaminated water. Control of the spread of this disease depends on the observance of hygiene in places where the people eat. All Army messes are being required to take extra care and precautions as to the health of their kitchen personnel and in the manner in which they handle food for the troops.

2. It is requested that Public Eating Places cooperate by doing the following things:

a. Arrange for all kitchen and dining room employees be inoculated against cholera at the earliest possible moment. A doctor's certificate stating that this has been done must be available. The cholera inoculation is in addition to the immunization against smallpox and typhoid that is required by Rule 1a of "Rules of Hygiene for Public Eating Places".

b. Employees who show any signs of sickness must not be allowed on the premises. Any employee showing symptoms of cholera must be removed to a hospital immediately. Anyone coming in contact with a cholera victim or his clothing should wash themselves thoroughly and change to freshly laundered clothing immediately. Known cholera contacts must not be allowed on premises for five days after last exposure.

c. The "Rules for Hygiene for Public Eating Places" recently distributed by the Allied Hygiene Committee is directed toward control of spread of disease. The observance of these rules now becomes of utmost importance, especially the ones concerning non-serving of uncooked vegetables, proper preparation and serving of fruits, boiling of milk, sterilization of drinking water, the non use of ice in beverages, elimination of flies from kitchen and proper methods of washing dishes and cutlery. You are requested to again review all these rules, and to make sure that your establishment is complying with them.

THE ALLIED HYGIENE COMMITTEE,
Calcutta,
25 April 1945.

Incl. No. 3

SANITARY INSPECTION

RESTAURANT

ITEM	DATES						
	1	2	3	4	5	6	7
1. Employees.....	1	1	1	1	1	1	1
2. Kitchen.....	1	1	1	1	1	1	1
3. Dish Washing.....	1	1	1	1	1	1	1
4. Food Storage.....	1	1	1	1	1	1	1
5. Waste Disposal.....	1	1	1	1	1	1	1
6. Food.....	1	1	1	1	1	1	1
7. Drinking Water.....	1	1	1	1	1	1	1
8. Salads.....	1	1	1	1	1	1	1
9. Insect Control.....	1	1	1	1	1	1	1
10. General Impression.....	1	1	1	1	1	1	1
11.	1	1	1	1	1	1	1
12.	1	1	1	1	1	1	1
Total "U" Item	1	1	1	1	1	1	1

Comments.

S - Satisfactory

U - Unsatisfactory

Inspection By:

Incl. No. 4

HEADQUARTERS
UNITED STATES FORCES
INDIA BURMA THEATER

CIRCULAR)
NO. 57)

A.P.O. 885,
24 May 1945.

- | | |
|---------------------------------------------------------------|-----|
| MALARIA CONTROL | I |
| RESCISSON OF SERVICES OF SUPPLY MEMORANDA | II |
| WATER PURIFICATION - IN BOUNDS CIVILIAN RESTAURANTS | III |

I. Malaria Control.

Paragraph 11b, Circular No. 11, this headquarters, dated 31 January 1945, is rescinded and the following substituted:

"Records of Atabrine Suppressive Treatment (AST). When military personnel are placed on atabrine suppressive treatment the following notation 'AST started on (date)' will be made under the space entitled 'Remarks' on all copies of their WD AGO Form 8-117 (Immunization Register). A similar notation will be made on the Certificate of Health furnished such individuals being returned to the Zone of the Interior."

II. Rescission of Services of Supply Memoranda.

1. The following Memoranda, Headquarters, Services of Supply, U.S.A.F., C.B.I., have become obsolete or have been superseded by more recent directives and are rescinded:

- a. Memorandum No. 4, dated 13 June 1942.
 - b. Memorandum No. 85, dated 4 September 1942.
 - c. Memorandum No. 26, dated 5 February 1943.
 - d. Memorandum No. 33, dated 19 February 1943.
 - e. Memorandum No. 122, dated 10 August 1943.
 - f. Memorandum No. 124, dated 12 August 1943.
 - g. Memorandum No. 138, dated 23 July 1944.

Incl. No. 5

h. Memorandum No. 146, dated 11 August 1944.

III. Water Purification - In Bounds Civilian Restaurants.

1. Recent surveys and inspections by the Surgeon's Office, this headquarters, have shown considerable improvement in the sanitary control of "In Bounds" civilian restaurants. However, it has been noted that drinking water, after boiling is frequently stored in a can or cooler in the kitchen from which it is drawn into glasses and served. The water is thus handled several times by native food handlers and is, therefore, subject to re-contamination.

2. All drinking water served to American troops should contain a free chlorine residual to afford protection from recontamination by handling. The most practical method of insuring adequate chlorination of water in civilian restaurants "in bounds" to our troops is to permit use of the Army issue calcium hypochlorite tubes (QM item No. 51-C-447, with testing kit and tablets).

3. In view of the above, authority is granted for the sale of QM Item No. 51-C-447 to civilian restaurant owners at the rate of two dollars and twenty cents (\$2.20) per hundred (100) tubes.

4. In order that this privilege will not be abused, Medical and/or Sanitary Officers at respective stations will personally insure that only "actual requirements" are sold to civilian restaurants.

BY COMMAND OF LIEUTENANT GENERAL SULTAN:

VERNON EVANS,
Major General, GSC,
Chief of Staff.

OFFICIAL:

/s/ FRANK MILANI,
/t/ FRANK MILANI,
Colonel AGD,
Adjutant General

Incl. No. 5

Calcutta, India

12 June 1945.

TO: ALL CAFES AND PUBLIC EATING PLACES
"IN BOUNDS" TO ALLIED TROOPS.

1. At most Calcutta Cafes, drinking water, after being first boiled is stored in metal cans or bottles for cooling. Although sterilized by the boiling, the water is subject to re-contamination by the later handling.
2. The most effective method of protecting drinking water against re-contamination is to have a small amount of chlorine in it. The chlorine acts as a policeman that will kill any germs (including those of cholera and typhoid) that might get in the water.
3. The Armies have a rule requiring that all drinking water consumed by troops must be chlorinated. In order to make it possible for "In Bounds" Cafes to do this, the Army Medical Department has made an arrangement whereby chlorine can be purchased from the U.S. Army Quartermaster Sales Store, 16, Sootekin Street (near Hindusthan Building) on presentation of a certificate.
4. It is requested that those Cafes desiring to remain "In Bounds" to Allied Troops purchase a supply of chlorine before 30 June 1945. Representatives of the Allied Hygiene Committee will visit your place shortly thereafter to show how the chlorinating should be done.
5. The chlorine that you will get comes in small glass ampules, 100 to a box. Each ampule contains enough chlorine powder to purify about 40 gallons of drinking water. The cost will be Rs.7/4/2 per box. One box should last most Cafes at least three months.
6. The attached certificate is to be presented when buying the chlorine. You will be given additional purchasing certificates as and when needed.

THE ALLIED HYGIENE COMMITTEE

Incl: Certificate.

Incl. No. 6

CALCUTTA, INDIA

Date, _____

C E R T I F I C A T E

This is to certify that.....

.....
requires box of calcium hypochlorite tubes for chlorinating
drinking water served to Allied troops.

THE ALLIED HYGIENE COMMITTEE.

Incl. No. 7

21 June 1945.

SUBJECT: Directions for Chlorinating Drinking Water

TO : Calcutta Cafes and Hostels "In Bounds" to allied Troops.

1. Equipment and Supplies required:

a. Water Container with tight cover and spigot outlet.
This water container should have a capacity of at least 10 gallons.

b. Calcium Hypochlorite (Chlorine) tubes.

2. Procedure:

a. Fill water container with corporation filtered water.

b. For every 10 gallons of water in the container add
one fourth of contents of one tube.

c. Let the water stand for 30 minutes then test it for chlorine as follows:

- (1) Draw a small amount of the water into a clear glass (a wine glass half full would be about the right amount).
- (2) Put in one of the Orthotolidine testing tablets.
- (3) Wait until tablet dissolves.
- (4) If the orthotolidine tablet makes the water in glass turn light yellow it means that there is the right amount of chlorine in it. The water is now sterilized and ready for drinking.
- (5) If the water turns an orange color it means that there is too much chlorine. In this event draw off some of the chlorinated water, replace it with corporation water, wait ten minutes and retest.
- (6) If the water does not turn yellow add more chlorine from the tube, wait 10 minutes and retest.

3. A fresh supply of chlorinated drinking water will be prepared every day. Drinking water left over from the day before will be thrown out.

Incl. No. 8

4. Drinking water containers will be kept clean and covered at all times.

5. If the chlorinated water is transferred to bottles or smaller containers for cooling in refrigerators great care must be taken to see that these smaller containers are kept clean and tightly covered or stoppered at all times.

6. It will not be necessary to boil the drinking water if chlorinated and handled in the above manner.

For the Allied Hygiene Committee:

/s/ D. C. TEAL
/t/ D. C. TEAL
Capt., Sn-C.,
U. S. Army

Incl. No. 8

HEADQUARTERS
BASE SECTION
I. B. T.
APO 465

Calcutta, India
16 August 1945

SUBJECT: Chlorination of water used for manufacture of soft drinks.

TO : Calcutta Soda Water and Soft Drink Bottling Plants.
"In Bounds" to Allied troops.

1. It has been found by experience that the most effective way of keeping soft drinks free from bacteria is by chlorinating the water used in its manufacture.

2. In order that soda water plants can do this, the Allied Hygiene Committee has made an arrangement whereby chlorine can be purchased from the U.S. Army Quartermaster Sales Store, 16 Sootekin Street, (near Hindusthan Building) on presentation of a certificate. The chlorine comes in five pound cans and will cost approximately Rs 5/- per can.

3. The attached certificate is to be presented when buying the chlorine. You will be given additional purchasing certificates as and when needed.

For the Allied Hygiene Committee:

1 Incl: Certificate.

D. C. TEAL
Capt., Sn-C.,
U. S. Army

Incl. No. 9

CALCUTTA, INDIA

DATE _____

C E R T I F I C A T E

This is to certify that.....

.....
requires _____ pounds of calcium hypochlorite (approximately one
month supply) for chlorinating water used in the manufacture of
soft drinks for Allied Troops.

THE ALLIED HYGIENE COMMITTEE

Incl. No. 10

RULES FOR THE MANUFACTURE OF ICE CREAM
THE ALLIED HYGIENE COMMITTEE, CALCUTTA.

OCTOBER 1945.

Ice cream is an excellent medium for the growth and transmission of disease-producing germs. Control of this potentially dangerous food becomes necessary. The following rules will govern:

1. General Requirements:

a. Any restaurant desiring to manufacture ice cream for Military personnel, or any manufacturer desiring to sell ice cream to Military installations or to "In Bound" restaurants, will first apply for permission in writing from the Allied Hygiene Committee, care of British APM, 303 L of C. Area, Calcutta, India. This application must give assurance that these rules are understood, and that all the required facilities are on hand in working order.

b. Upon receipt of an application, the Allied Hygiene Committee will send representatives to investigate, and to decide whether the applicant is prepared to operate under these rules.

c. If the Committee is satisfied, a "Certificate of Approval" will be issued to the applicant. This certificate will be withdrawn for any violation of this code.

2. Premises:

a. A room or section thereof will be reserved for the preparation and freezing of ice cream and will not be used for any other purpose while ice cream is being manufactured.

b. The premises will be kept in good state of repair and will be clean and tidy, well-lighted and well-ventilated and of sufficient size. They will be free of flies, cockroaches, ants, rats, mice, and other vermin and will be fly-proofed if necessary.

3. Employees:

a. Must be in good health free from disease, and skin, respiratory and bowel disorders.

b. Immunization. New employees before starting to work as well as old employees, must have the following immunizations, within the time specified:

- (1) Smallpox vaccination - 2 years.
- (2) Typhoid inoculation - 1 year.
- (3) Cholera inoculation - 6 months.
- (4) A record of these three inoculations will be maintained by the employer in a separate notebook using the following form:

:	:	:	<u>D A T E</u>	:	:
:	:	:		:	:
:	:	:		:	:
:	EMPLOYEE'S NAME	: SMALLPOX	: TYPHOID	: CHOLERA	:
:		:		:	:
:		:		:	:
:	John Doe	: Jan. 5, 1945	: Jan. 5, 1945	: June 11, 45	:
:		:		:	:
:		:		:	:

- (5) A certificate by a registered physician showing the name of the employee immunized, and the type and date of immunization must be available to verify the above record. All certificates will be kept in one file.

c. Must be clean of person, have finger-nails clipped short, and hair trimmed. They must wear separate clothing or overalls while manufacturing or handling ice cream. This clothing must not be used for any other purpose and must be kept on the premises.

4. Equipment.

a. All equipment and utensils used for the manufacture of ice cream will be used for that purpose only, and will be kept entirely separate from other equipment.

b. Equipment used in the manufacture of ice cream must be rust-proof and scrupulously clean. Containers must be fitted with tight covers which protect the lips opening from contamination. The interiors of vehicles used to transport ice cream will be clean.

c. All containers, utensils, and other equipment, will be thoroughly cleansed immediately after each using. Minimum cleansing will consist in scouring with powder, washing in hot soapy water, and thorough rinsing with boiling water. The equipment will then be air-dried in a clean location and stored in an enclosed safe or cupboard. All containers, spoons, pans, buckets, etc. will be inverted at once after the final rinse, so that moisture will drain immediately, and so that all surfaces will be exposed to the air. All equipment will be rinsed with boiling water immediately before use.

d. The ice container surrounding the freezer shall have at least two holes, a minimum of one-quarter of an inch in diameter, placed at least two inches below the lower lip of the cover on the ice cream containers. This will prevent ice water from contaminating cover or leaking into the ice cream.

e. Refrigerators or ice-boxes must be adequate in size, efficient in operation and sanitary.

f. Scoops will be of a commercial type, easy to clean and with a handle long enough to prevent employees' hands from contacting the ice cream. Ice cream will not be removed from scoops with the fingers. Ice cream scoops will be cleaned and maintained as follows:

- (1) Scoops will be rinsed in a container of drinking water which is changed hourly.
- (2) After rinsing in drinking water, scoops will be transferred at once to a strong chlorine solution where they will remain when not in use. This strong chlorine solution will be prepared fresh daily by dissolving one ampule of calcium hypochlorite in one quart of water.
- (3) The handles of scoops will not be submerged in either solution. Ice cream will be dipped by scoops which come directly out of the chlorine solution.

5. PROCESS:

a. All ingredients will be obtained from source approved by the Allied Hygiene Committee; will be of the highest quality obtainable; and will be kept in covered labeled containers. Milk and cream will be pure and wholesome, free of extraneous matter, adulterants, preservatives or other artificial substance.

b. The following ingredients are prohibited:

- (1) Fruit, artificial coloring, preservatives or any potentially dangerous ingredient.
- (2) Corn starch or filler or other ingredient not in the manufacture of the highest quality ice cream.

c. All ingredients (flavoring excepted, if desired) will be subjected, after mixing, to a process of sterilization by boiling for at least 5 minutes. Cooling of the ice cream mix after boiling, and transfer to the freezer will be accomplished as rapidly as possible.

d. From the time the ingredients are mixed until the product is finished, care will be taken to prevent contamination from any source. The product will be kept covered at all times excepting temporarily for inspection or serving. Covers removed from containers will be placed upsidedown on a clean surface. The inside of containers or covers will not be touched. Transfers of ice cream from one container to another will be made rapidly in a sanitary manner using clean utensils.

e. All ice cream after manufacture will be kept in approved containers which have been thoroughly cleansed and rinsed with boiling water or steam treated before filling. These containers will be kept entirely separate pending sale or distribution, and will be sealed at all times until reopened for direct sale on the premises.

6. Labeling:

All containers of ice cream will be conspicuously and securely labeled with manufacturer's name and date of manufacture.

No establishment permitted to serve ice cream will have on its premises, any container of ice cream which is not properly labeled.

THE ALLIED HYGIENE COMMITTEE,
CALCUTTA, INDIA
October 1945.

Incl. No. 11

CERTIFICATE OF APPROVAL

Calcutta, India
19 October 1945.

To all Concerned:

This is to certify that _____ has qualified with the requirements of the Allied Hygiene Committee and is authorized by them to manufacture Ice Cream for consumption by Allied Troops.

FOR THE ALLIED HYGIENE COMMITTEE:

Incl. No. 12

REFERENCES

1. Indian Year Book and Who's Who for 1943-44,
Times of India Press, Bombay.
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4. "The Statesman", 26 April 1945.
5. "The Statesman", 17 May 1945.
6. Extract from Ltr, Hq, SOS, USF, IBT, APO 885,
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dated 9 November 1944.
7. "The Statesman", 2 May 1945, Editorial Page.

